OFFSHORE ENVIRONMENTAL RESEARCH AND DEVELOPMENT RELATED TO OFFSHORE OIL AND GAS ACTIVITIES IN CANADA:

Background Document and Results of the Government / Industry Workshop and PERD 6.7 Committee Meeting held in Calgary, Alberta February 11-13, 1985

Prepared for:

Environment Canada

on behalf of the

Interdepartmental Panel on Energy Research and Development

Task 6: Conventional Energy Systems – Oil, Gas, Electricity.

Environment Committee

July 1985

R-50

OFFSHORE ENVIRONMENTAL RESEARCH AND DEVELOPMENT RELATED TO OIL AND GAS ACTIVITIES IN CANADA:

Background Document and Results of the Government/Industry Workshop and PERD 6.7 Committee Meeting held in Calgary, Alberta, February 11-13, 1985

By:

David J. Thomas
Seakem Oceanography Ltd.

George D. Greene
Consultant

and

Wayne S. Richardson
Environment Canada

Prepared for:

Environment Canada

on behalf of the

Interdepartmental Panel on Energy Research and Development
Task 6: Conventional Energy Systems - Oil, Gas, Electricity,
Environment Committee

July 1985

The correct citation for this report is:

Thomas, D.J., G.D. Greene, and W.S. Richardson. 1985. Offshore Environmental Research and Development Related to Oil and Gas Activities in Canada. Background Document and Results of the Government/Industry Workshop and PERD 6.7 Committee Meeting held in Calgary, Alberta, Feburary 11 - 13, 1985. 22 pp. + Appendices.

PREFACE

This report summarizes the results of a workshop held jointly with industry and government in Calgary in February, 1985 and also the results of a Panel on Energy R&D (PERD) Task 6 Environment Committee meeting held immediately following the Workshop to reassess R&D priorities and overall objectives. The detailed background review of offshore environmental R&D resources related to oil and gas activities in Canada, which was provided to all workshop participants, has been extensively revised and is also included in this report in Appendix A.

The Workshop was successful in meeting its objectives and provided a useful forum for individuals from various disciplines to gain some appreciation for the overall state of environmental, oil and gas-related offshore R&D in Canada. The Workshop also provided a significant contribution to consolidating and focussing the views and direction of the PERD Task 6 Environment Committee. Appendix A provides a good overview in this regard. Unfortunately, the scope of the Workshop was not wide enough to establish a comprehensive plan for offshore environmental R&D coordination and priority-setting outside of the PERD framework. However, this report provides a useful step towards improved coordination and co-operation of the various R&D programs discussed at the Workshop.

I would like to express my sincere thanks to all the workshop participants who contributed their valuable time, information and critical reviews of the R&D activities discussed at the workshop. I am especially grateful to the Canadian Petroleum Association, Offshore Operators Division and to the Arctic Petroleum Operators Association for their support and for the provision of industry facilities for the workshop and meeting. Particular thanks are extended to my fellow co-chairman, Dick Stoddart (DFO/OSS) and to the members of the Task 6 Environment Committee for their assistance, support and report review and to Diane Campbell (EMR/OERD) for her able assistance in editing the draft report. I also wish to acknowledge the staff at Seakem Oceanography for their assistance in the report preparation (G. Hosick, B. Fraser, B. Perry and A. Francis). Thanks also to George Greene and Dave Thomas for their extra efforts in organizing the Workshop.

Wayne S. Richardson, P.Eng.
Workshop Chairman and
Co-Chairman, PERD Task 6
Environment Committee

SUMMARY

A joint government/industry-sponsored workshop on offshore environmental research and development related to offshore oil and gas activities in Canada was held in Calgary, Alberta on February 11 and 12, 1985. The objectives of the Workshop were:

(1) to provide an overview of current offshore environmental R&D activities in Canada; this is to serve as a context for research and development in Environmental Forecasting and Environmental Impacts funded by the Task 6 Environment Committee (PERD 6.7);

(2) to provide a forum for the presentation and discussion of the R&D activities and role of the Environment Committee of PERD Task 6;

(3) to identify clients and to discuss their needs for Offshore Environmental R&D related to oil and gas activities, and priorities for future federal government R&D within the PERD Task 6 program; and

(4) to signal PERD 6.7 areas of interest to research managers who are planning future submissions to the PERD Environment Committee.

The main outputs of the Workshop were:

(1) an overview of the role of PERD 6.7 in offshore R&D in Canada with emphasis on the concerns about the current status of PERD 6.7, and funding and organisational priorities for the future;

(2) a list of issues that must be addressed by all PERD 6.7 projects; and

(3) a critique of procedural issues for reviewing PERD 6.7 projects.

Following the Workshop, a PERD 6.7 Committee Meeting was held. The main outputs of this meeting were:

(1) re-evaluation and re-statement of the role, objectives and procedures of PERD 6.7;

(2) a list of objective and subjective selection criteria for study proposals; and

(3) a list of subject areas suggested for priority funding, subject to the availability of funds, by PERD 6.7.

(4) a list of 31 subject areas proposed for priority under PERD 6.7; and

(5) a list of subject areas that will not be considered for funding under PERD 6.7.

The concerns about the current status of PERD 6.7 and the future funding and organisational priorities expressed during the Workshop and the many program presentations made at the Workshop were thoroughly discussed during the Committee Meeting and will contribute significantly to the review process of new and renewing proposals to the Committee.

TABLE OF CONTENTS

		Page
PREFACE		i
SUMMARY		ii
TABLE OF CONTENTS		iv
1.0	INTRODUCTION	1
2.0	REVIEW OF THE ROLE AND OBJECTIVES OF PERD 6.7	5
	2.1 PERD Objectives	5
	2.2 Role of PERD 6.7	7
	2.3 Selection Criteria for Study Proposals	9
3.0	CONCERNS AND ISSUES REGARDING PERD 6.7 ACTIVITIES	14
4.0	CONCLUDING REMARKS	22

APPENDICES

APPENDIX A.	Background document on offshore environmental research and development related to oil and gas activities in Canada	A-1
APPENDIX B.	PERD 6.7 program accomplishments, 1981 - 1983	B-1
APPENDIX C.	Definition of R&D	C-1
APPENDIX D.	List of participants at the workshop on offshore environmental research and development related to oil and gas activities in Canada, February 11 - 12, 1985.	D-1
APPENDIX E.	List of attendees at the PERD 6.7 Committee Meeting, February 13, 1985.	E-1

1.0 INTRODUCTION

A workshop on offshore environmental research and development related to offshore oil and gas activities in Canada was held in Calgary, Alberta on February 11 and 12, 1985. The Workshop was sponsored by the Federal Government (through the Interdepartmental Panel on Energy Research and Development (PERD)) and industry (through the Offshore Operators Division, CPA and the Arctic Petroleum Operators Association) and was attended by representatives from various Federal and Provincial government departments and the oil industry (Appendix A). The overall co-ordinating structure of PERD and the committee structure of PERD Task 6 are shown in Figures 2.1 and 2.2 of Appendix B. The objectives of the Workshop were:

(1) to provide an overview of current offshore environmental R&D activities in Canada; this is to serve as a context for research and development in Environmental Forecasting and Environmental Impacts funded by the Task 6 Environment Committee (PERD 6.7);

(2) to provide a forum for the presentation and discussion of the R&D activities and role of the Environment Committee of PERD Task 6;

(3) to discuss client needs for Offshore Environmental R&D related to oil and gas activities, and priorities for future federal government R&D within the PERD Task 6 program; and

(4) to signal PERD 6.7 areas of interest to research managers who are planning future submissions to the PERD Environment Committee.

The overview of current offshore environmental R&D activities in Canada including a summary of the sources of funds for these R&D activities was provided at the Workshop in the background document "Offshore Environmental Research and Development in Canada Related to Oil and Gas Activities". An updated and revised version of the background document is included in this report as Appendix A.

The Workshop included a series of presentations (Table 1) on current and future research activities and priorities in the two PERD 6.7 subject areas (Offshore Forecasting; Offshore Impacts) by representatives of the various groups conducting the research.

The main outputs of the Workshop were:

(1) an overview and appreciation of the role of PERD 6.7 in offshore R&D in Canada with emphasis on the concerns about the current status of PERD 6.7, and funding and organizational priorities for the future;

(2) a list of what will not be considered for funding under PERD 6.7; and

(3) a list of issues which must be addressed by all PERD 6.7 projects.

TABLE 1.

List of Organisations Making Presentations on Current and Future Research Activities in Canada Relevant to PERD 6.7 Subject Areas (acronymns defined on page A-5)

OFFSHORE FORECASTING

1. Atmospheric Environment Service (AES), Downsview, Ont.
2. Atlantic Oceanographic Laboratory (AOL), Bedford Institute of Oceanography (BIO), Dartmouth, N.S.
3. Marine Ecology Laboratory, Bedford Institute of Oceanography, Dartmouth, N.S.
4. Bayfieid Laboratory, Burlington, Ont.
5. Institute of Ocean Sciences, Sidney, B.C.
6. Canadian Atlantic Storms Program (AES and AOL/BIO)
7. Offshore Operators Division, Canadian Petroleum Association (CPA) and Arctic Petroleum Operators Association, Calgary, Alta.

OFFSHORE IMPACTS

1. St. Andrews Biological Station, St. Andrews, New Brunswick
2. Fisheries Research Branch, St. John's, Nfld.
3. Marine Ecology Laboratory, BIO, Dartmouth, N.S.
4. Freshwater Institute, Winnipeg, Man.
5. Canadian Wildlife Service, Ottawa, Ont.
6. Environmental Protection Service (EPS), Yellowknife, N.W.T.
7. Environmental Protection Service, Dartmouth, N.S.
8. Arctic and Marine Oilspill Program, EPS, Ottawa, Ont.
9. Atlantic Oceanographic Laboratory, BIO, Dartmouth, N.S.
10. Institute of Ocean Sciences, Sidney, B.C.
11. Canada Centre for Remote Sensing, Ottawa, Ont.
12. Offshore Operators Division (CPA) and Arctic Petroleum Operators Association

Following the presentations, representatives of the various government departments and industry provided overviews of the role of PERD 6.7 in offshore R&D in Canada. These presentations and overviews dealt with the following major questions:

- what is being done with PERD resources?
- is the current distribution of resources appropriate by subject area and by region?
- are R&D activities meeting the needs of industry and of government departments?
- if not, where is emphasis needed?
- what do you expect PERD 6.7 R&D to accomplish?

A summary of the concerns and priorities identified in the overviews is given in Section 3.0 of this report.

After the completion of the Workshop, a meeting of the PERD 6.7 (Environment) Committee was held (February 13). The purpose of this meeting was:

(1) to review the results of the Workshop and discuss implications to PERD 6.7; and

(2) to develop signals to R&D managers on PERD 6.7 areas of interest.

The main outputs of the PERD 6.7 Committee Meeting held February 13, 1985 were:

(1) Re-evaluation of the role and objectives of PERD 6.7.

(2) A list of selection criteria for study proposals.

(3) A list of priority areas for PERD 6.7 funding.

Many concerns and issues were raised over various aspects of PERD 6.7 activities. Section 3.0 outlines some of the major points made during the Workshop and Committee Meeting, and provides comments or responses to each concern. Attendees at the Committee Meeting are listed in Appendix E and the definitions of R&D, data collection, monitoring, etc. used during the sessions are shown in Appendix C. The accomplishments of the PERD 6.7 program resulting from projects carried out from 1981 to 1983 have been included in this document (Appendix B) to provide a more complete overview of the PERD 6.7 program.

2.0 REVIEW OF THE ROLE AND OBJECTIVES OF PERD 6.7

The PERD Task 6 Environment Committee thoroughly reviewed the existing statements of its role, objectives and project selection criteria in the light of the concerns and issues raised during the Workshop. These objectives and criteria are presented here to provide a basis for future PERD 6.7 decision making.

2.1 PERD Objectives

Overall PERD Objectives

(1) to develop technological options which can be made available in future years to respond to higher energy costs and increasing unavailability of conventional energy supplies;

(2) to enhance the technical basis for the deployment of technologies which are already developed;

(3) to provide technical information as a basis for energy policy decisions.

PERD Task 6 Objectives

(1) Ensure through R&D that there is sufficient technical knowledge for the federal government to discharge its policy, forecasting and operational service, regulatory and jurisdictional responsibilities relating to the supply of light-medium gravity crude oil, natural gas and electricity.

(2) Complement industry in providing technological support for achieving near-term security in domestic oil and natural gas supply by 1990, thus providing time to develop options for the long-term future, well beyond 1990.

Task 6 Philosophy

The philosophy behind the accelerated funding of this Task is not to provide another research arm for an already established industry, but rather to assist several

government departments in responding to the opportunities and demands posed by a federal energy policy which has encouraged increased industry exploration and development activity in the offshore and Canada Lands. The interdepartmental consultation process of the Panel enables programs in the Task to be planned in recognition of the diversity of the non-energy policy mandates of these departments, such as fisheries, hydrography, transportation, northern affairs, industrial development and environmental management. This is in additon to supporting the directly energy-related regulatory and policy needs of COGLA and EMR.

The R&D carried out in Task 6 has, therefore, a primary role to provide the federal government with a technical basis to meet its responsibilities. These are:

- to regulate oil and gas developments, particularly in the Canada Lands, onshore (N.W. Territories) and offshore (Arctic, Atlantic and Pacific), through agencies such as COGLA and Transport Canada;

- to provide essential services such as weather, sea and ice forecasting and hydrographic charts, and a regional understanding of environmental and geotechnical processes in the Canada Lands through departments such as Environment Canada, Fisheries and Oceans, and Energy, Mines and Resources;

- to provide "independent" expert opinion in public fora such as environmental impact evaluation hearings convened by FEARO or COGLA, or Commissions of Enquiry;

- to evaluate national hydrocarbon reserves and resources;

- to assist Canadian supply and service industries to be competitive;

- to establish national standards, for example in calibration of electrical equipment by the NRC; and

- to encourage a sharing of research programs and results nationally, for example amongst utilities through the Canadian Electrical Assocation.

Priority Areas - All Task 6

Priority 1 (Major Effort)

- Atlantic Shelf (Hibernia, Sable)
- Beaufort Sea, Nearshore
- Oil and Gas from Conventional Reservoirs including Enhanced Recovery
- Substitution of Alternatives to Oil-Fired Electricity Generation.

Priority 2 (Watching Brief)

- High Arctic (far offshore Beaufort, Arctic Islands, Sverdrup Basin)
- Atlantic Slope and Labrador Shelf
- West Coast *
- Oil Shales
- Gas from Tight Formations

* 6.7 Committee members would like recommendations to go to the Task Coordinating Committee stating that since the West Coast moratorium has been imposed because of environmental concerns, West Coast environmental R&D should be a relatively high priority and should be funded.

2.2 Role of PERD 6.7

(1) to ensure availability of funds to federal government departments to perform appropriate and adequate in-house or contract R&D that will assist the departments to meet their responsibilities in regard to the PERD 6.7 program objectives; and

(2) to complement industry in technological development.

Specific Objectives of PERD 6.7

(1) To develop technologies, methods and models to improve the forecasts of environmental states (ice, sea and weather) for the exploration, development and transportation of hydrocarbons.

(2) To improve the capability to reduce environmental impacts, to develop mitigative technologies, to detect and measure impacts and to monitor the environmental effects resulting from hydrocarbon developments.

The Committee agreed to interpret the overall objectives in the following way:

To provide federal government departments with the information and tools (models, methods and technologies) to develop or enhance at an accelerated rate, their capabilities to:

(1) evaluate industry development proposals, environmental impact statements and other submissions:

(2) advise the regulators of the oil and gas industry on appropriate technologies, discharge limits and other matters suitable to achieving environmental acceptability;

(3) carry out adequate formulation, enforcement and surveillance of regulations;

(4) detect changes in environmental systems or their components caused by oil and gas development (in support of objectives 1, 2 and 3 above) in the geographical priority areas defined by Task 6; and

(5) recognise and resolve key biological constraints, improve essential weather, sea and ice forecasting, and advance the understanding of physical environment processes.

2.3 Selection Criteria for Study Proposals

One set of objective (Yes/No) selection criteria and another of subjective criteria were developed by the PERD 6.7 Committee for use in the evaluation of study proposals for PERD 6.7 funding.

Yes/No Criteria

1. Is the proposed project relevant to offshore energy development? (Yes/No). Evaluation of relevance may include consideration of:

   (a) need for information for design or operation;
   (b) time framework for project;
   (c) contribution toward removal of impediments to development; and
   (d) enhancement of development economics.

2. Does the project meet the expressed objectives of PERD 6.7? (Yes/No).

3. Is a similar project being funded by others? (Yes/No)

4. Is there a need for an accelerated approach? (Yes/No)

5. Does the proposed schedule for completion of the project fall within an acceptable time frame? (Yes/No)

6. Is the project relevant to the Task 6 priority areas? (Yes/No)

Subjective Criteria

1. What is the quality of the project proposal?

2. What are the funding requirements of the proposal?

3. Does the proposal provide adequate documentation; for example, are milestones and study outputs reasonable and achievable?

4. What is the probability of success of the project? Does the project have a definite and logical conclusion?

5. Does the proposed project have commercialization potential?

6. Is there a possibility that the project will be funded by others?

7. Is the project receiving A-base support?

8. How does the proposed project relate to other projects within government, industry or the international scene?

Application of Selection Criteria

The suggested steps for evaluation of project proposals are:

Step 1. Evaluate project proposals according to the Yes/No (objective) criteria. This step applies to both new projects and those that are being considered for renewal. Re-evaluation of project relevance is a key consideration for on-going studies and provides a rationale for continuing, terminating or re-focussing them.

Step 2. Evaluate project proposals according to subjective criteria.

Step 3. For proposals being considered for renewal of on-going research, evaluation of past performance will be a key evaluation criterion. In addition, successful performance will also be judged in terms of the number and quality of reports and publications arising from the research and whether or not the project achieved its original objective.

Subject Areas Outside PERD 6.7 Funding Objectives

The workshop participants identified the following subject areas as falling outside the PERD 6.7 funding objectives:

1. on-going monitoring activities;

2. on-going baseline data collection;

3. departmental A-base R&D objectives (normal paces of R&D); and

4. R&D which solely meets the objectives of other accelerated federal R&D Funds (NOGAP, AMOP, ARCTIC Marine Transport R&D, etc.) or ESRF.

Issues Which Must be Addressed by all PERD 6.7 Projects

1. Safety of life and property; or

2. Resource use conflict; or

3. Methods for measuring the incremental impact of oil and gas development on the offshore environment; or

4. Improve the economics/optimize oil and gas operations in an environmentally acceptable manner.

General Discussion of PERD 6.7 Programme Funding

Considerable time was spent at the Environment Committee meeting reviewing and discussing ongoing and proposed work funded through the PERD 6.7 program. Table 2 provides a listing of the major topics discussed at the meeting. This is not a complete 6.7 program listing, as many specific ongoing projects were not discussed in detail, and many of the subject areas are not considered appropriate for new or additional funds.

The Committee identified a few subject areas where it considered that new proposals would merit serious consideration. These areas are:

(1) Development of remote sensing methodologies for the study of marine mammal behaviour.

(2) Study of the long-term fate and effects of oil and gas activities on biological resources.

(3) Monitoring techniques to assess significant biological effects at the population level.

(4) Minimum thickness of oil on water that will cause bird mortality.

(5) Day-one forecasting.

3.0 CONCERNS AND ISSUES REGARDING PERD 6.7 ACTIVITIES

The following concerns about the current status of PERD 6.7 activities and funding and organizational priorities were identified in the summary synopses presented by representatives from government and industry at the conclusion of the two-day workshop. They are presented here to reflect, in a straightforward way, the broad spectrum of comments about PERD 6.7 and its activities that were expressed at the Workshop. The concerns and priorities are, however, largely the opinions held by individual workshop participants. Many of these concerns demonstrated a lack of knowledge of the details of the PERD program on the part of the person(s) raising the concern. The concerns and priorities were debated during the Workshop and the Committee Meeting but do not necessarily represent concensus or general conclusions of the participants. They were taken into consideration by the Environment Committee during the 6.7 Committee Meeting (February 13) to re-evaluate the role and objectives of PERD 6.7 and to guide the future direction of R&D funded by PERD 6.7.

Concern/Issue	Remarks/Responses/Action
1. There appears to be no clearly defined purpose for PERD 6.7. The objectives and focus of program needs are ambiguous.	
- Without a clearly stated purpose it is not possible to assess whether the level of funding and the balance and distribution of funds among objectives applied to PERD 6.7 are adequate.	- There has been a clearly defined purpose, for many years, for PERD 6.7 within the context of PERD Task 6. A revised statement is provided in Sections 2.1 and 2.2.
- Without a clearly defined purpose, it is difficult for researchers to know what projects are likely or unlikely to be supported by PERD 6.7.	- A clearly defined purpose has existed for several years. However, any stated purpose will have to be sufficiently general so as to encompass a very broad range of research areas. PERD will never become so inflexible as to dictate project-level purposes.
- It was suggested that if 6.7 R&D is clearly and directly linked to offshore oil and gas, then it should be client-driven and funded by PERD, NOGAP or ESRF.	- This is how PERD generally does function, with the important note that "client" includes federal government departments.
- On the other hand if the R&D has a broad mandate and will produce basic research results which will be useful to multiple users, including offshore oil and gas interests, then funding should come directly from universities and departmental A-bases. This R&D should be driven by the research community.	- True, unless the R&D is of sufficient importance to departments that the R&D should be accelerated, in which case PERD could extend funding.
2. A better balance between short-term and long-term projects.	- PERD 6.7 operates within short to medium term framework since it is within this context that Task 6 works. A conscious effort has been made by the 6.7 Committee to have a balance of short to medium term projects. This is not necessarily obvious in 6.7 accomplishments because the program is only a few years old. As long-term projects are submitted ot the Committee for review, there is a possibility that a slight shift could occur towards the longer term in the overall balance of 6.7.

3.	No mention was made of the results from BIOS, EAMES, OLABS, and OCESEAP studies in the context of evaluating the current state of knowledge or in guiding future R&D priorities.	- The evaluation of "the current state of knowledge" and its application to research proposals is the responsibility of the researcher and research manager. PERD expects that current state of knowledge forms the basis for any project submitted for funding.
4.	There are too few person-years (p-y's) to manage contract R&D effectively. Some government departments believe that they are unable to expand their R&D activities for lack of p-y's to manage contracts.	- If this is a problem seriously affecting the quality of the R&D then a formal statement to that effect should be made by those departments to the Committee, accompanied by an analysis of what level of resources they <u>are</u> able to effectively manage. The recommendation should then be made that the Committee consider reallocation of funds to other departments that could use them effectively (i.e. CASP-like reallocation).
5.	It is not clear how ESRF/PERD/NOGAP/Industry/ Government A-base interact.	- A description of the linkages between these elements can be found in the "Background Document on Offshore Environmental Research and Development in Canada Related to Oil and Gas Activities" (Appendix A).
6.	Much PERD funded R&D ignores results of work conducted in other parts of the world. It was suggested that much of the R&D conducted outside Canada, on topics relevant to PERD 6.7, is probably valid in Canada. Even within Canada, there has been a reluctance to evaluate the validity of extrapolating East Coast results to the West Coast.	- This concern reflects on the project proponents themselves. Responsible project managers presumably decide whether a project is relevant and this includes being aware of other ongoing and completed work in their field of expertise. The 6.7 Committee can help in a limited way through its discussions. In many instances, similar work must be repeated in unique environments.
7.	Using the amount of money spent on R&D may be misleading when estimating scientific progress because the cost of a scientific program may have little bearing on the validity of the results. Expensive programs can and have produced poor, misleading or no useable results.	- This comment pertains to the "Background Document", the intention of which is <u>not</u> to estimate scientific progress or imply anything regarding the quality of the research. Its purpose is to show funding levels and distribution.
8.	Results from PERD funded studies are not getting to regulators or other users in a timely manner.	- This means that researchers and research managers need to be given more stringent time constraints. PERD managers, however, do not feel that there is a shortcoming in this respect (in terms of PERD receiving research results).

9. There is currently too much emphasis on hindsight and too little emphasis on foresight in PERD projects.

- "Hindsight" is taken to mean filling gaps of knowledge in technology areas which are currently under investigation in government, university and industry in a "reactive" way. There will always be an emphasis on this type of project in PERD because these gaps in knowledge are in areas outside of stated mandates and are identified as priority R&D projects on an ongoing basis. Foresight (or a "pro-active" approach) is shown in CASP-like projects and in the major review of offshore production wastes funded by PERD 6.7. When opportunities arise to embark on this type of effort, the Committee will act on them. It is unreasonable to expect that projects like CASP will come up on a continuing basis or that PERD should operate solely in a pro-active mode. The flexibility to use both approaches, when and where they are appropriate is what enables PERD to act as an accelerating fund, meeting very diverse needs.

10. There is a need to look more carefully at the energy needs for Canada as a whole rather than the needs of the research community.

- This, in effect, is what PERD is all about. PERD programs are set in the context of Canada's energy needs and the needs of "the research community" should hopefully reflect departmental viewpoints and, when possible, industry needs.

11. There is insufficient PERD-funded R&D directed to West Coast issues. It is recognised that the West Coast is not a priority area for PERD projects because of the moratorium on offshore oil and gas exploration. It is also recognised, however, that a lack of specific scientific information is an impediment to lifting the moratorium. An initiative by PERD to fund projects on the West Coast was suggested as a means by which the federal government could improve its preparedness for offshore oil and gas issues on that coast.

- This issue was discussed by the Committee and will be viewed as a recommendation to be made through the Task 6 program structure.

12. Some industry representatives believe that some existing PERD-funded projects appear to be of limited practical use (to industry).

- If the projects referred to by industry were funded specifically because they were intended to respond to industry needs then the Committee should request that project proponents demonstrate the need for continuing funding. If the projects are responding to government needs then the criticism is unfounded because PERD responds to more than one client.

13. Some industry representatives indicated that in some cases, PERD contradicts one of its objectives by establishing an impediment to offshore development through following unclear and unfocussed research paths rather than providing solutions to the removal of obstacles to offshore development.

- PERD's job, as has been clearly stated, is to remove impediments to offshore development in a manner which ensures that resource conflict and environmental degradation does not occur. To do this, there must be a great deal of flexibility in PERD 6.7's research requirements. This means that PERD is not always able to provide solutions to the removal of development obstacles if research (no matter how seemingly "unclear" it is) suggests that a potential problem exists for other resources (i.e. fisheries). This is not a contradiction in objectives, it is a matter of serving more needs than just industry ones.

14. List PERD priorities clearly and show what criteria should be used to set them. At present, each government department and oil company has its own priorities. A set of priorities, in conjunction with well-defined objectives will allow both government and industry to specify what they expect PERD 6.7 funding to accomplish.

- This area was discussed during the Workshop and Committee Meeting and some priority areas were suggested (see Section 2.3). Not all the research needs in 6.7 were brought forward for discussion. There will undoubtedly be some suggestions in the oceanography and forecasting areas since these were not discussed in the same detail as impact study needs.

15. There is a need to strike a balance between those things which the government needs to know (in order to assist the oil and gas industry to develop offshore reserves in a timely and efficient manner) and those things that are merely nice to know.

- The government needs to do R&D in order to satisfy its own mandate with respect to offshore oil and gas (e.g. safety, environment). Its role is to complement industry and university research, not act as an extension of industry interests. "Things that are merely nice to know" do not need to be accelerated and therefore are not and never have been priorities of PERD 6.7.

16. Investigate ways by which results from R&D projects related to offshore oil and gas developments outside Canada can be transferred to those occurring within Canada.

- This concern exists for all R&D projects within government, university and industry. To what extent R&D funding organisms can satisfy a technology transfer problem can be debated but it is ultimately the decision of researchers and research managers within both government and industry to keep abreast of promising foreign technologies and to decide whether they should or can be transferred to Canada.

17. The potential overlap of PERD, NOGAP, ESRF and A-base R&D activities must be minimized.

- Committee 6.7 does not consider that an overlap exists. The linkages between PERD, NOGAP, ESRF and A-base are described in the Background Document, Appendix A.

18.	Results from PERD R&D projects should be published in the open literature and subjected routinely to critical review.	- PERD results are routinely subjected to both internal and external review. Much of the R&D PERD supports is published in the open literature.
19.	PERD R&D data should be available in a form to more directly satisfy client needs (i.e. format compatibility with user needs, publishing all results in a fixed format, etc.).	- This can be and is done to a limited extent. PERD will, however, not take on an information management role in this respect. Perhaps more discussion between researchers from government, university and industry at the start of projects or at the proposal stage would help alleviate data format problems.
20.	Control measures should be put in place for PERD studies to quantify the quality of the data obtained. In addition, the steps that must be undertaken to assure quality of data should be specified.	- Any control measures of this kind are the responsibility of the researcher or contract manager and since they are presumably the primary users of the R&D data, this concern should really not exist at the 6.7 Committee level. PERD 6.7 should not have to dictate good research practices.
21.	Increased industry participation is required in PERD 6.7 program development, project selection and the implementation of R&D results.	- Industry participation is a vitally important part of the whole of Task 6. Increased participation in 6.7 activities through the existing industry representatives on the 6.7 Committee would be most welcome.
22.	The Canadian Atlantic Storms Program (CASP) is a high priority and is seen as an excellent example of the co-operation between industry and government and between government departments. Industry views CASP as a good model for future PERD-funded projects because it is well focussed R&D and they anticipate results of the project will fill an important and practical information gap.	- PERD will endeavor to support projects of this type whenever possible. Any new initiatives, which can be modelled after CASP, should be brought to the Committee's attention.
23.	Industry data and research results should be made available to both government and industry.	- This would help activate the many linkages which exist between government and industry and would also tend to reduce the criticisms that the government is duplicating research efforts or is not satisfying industry needs.

24.	Closer links between government and industry are needed so that results of R&D projects can be exchanged effectively among the appropriate science, industry and regulatory managers.	- Many links exist at the present time. The problem is more one of effectively using these links. In addition, there is a great deal of communication occurring between researchers, for instance, of which managers are not aware, and vice versa. In other words linkage problems exist within government and within industry that need to be resolved.
25.	Data management systems must be incorporated into R&D projects so that research results can be accessed in a timely fashion and be available for the planning of new and on-going studies. Many studies currently underway suffer from information overload to the point that new data are being generated faster than they can be assimilated into project management and planning.	- This problem should be resolved at the project level. Researchers and research managers should be aware of any constraints, including information management, when a project is submitted.
26.	Long-term studies of biological effects of offshore oil and gas development should be emphasized. At the present time, there is no effective means of detecting mid and long-term effects. Improvement of detection techniques for quantifying the overall health of animals/polulations, should be a priority. Impact studies should be linked clearly and strongly to effects on biological resources used or otherwise valued by people.	- These comments have been considered by the PERD 6.7 Committee and are reflected in the discussions of priority areas for future funding.
27.	Development of methods for measuring the incremental or perhaps cumulative impact of offshore oil and gas development on the biophysical environment is a priority. It was strongly recommended that this subject area be referred to the PERD Task 7 Committee (Co-ordination and generic studies) for funding consideration.	- If this type of project is indeed a priority for oil and gas development then the 6.7 Committee should consider it. It is perhaps possible, but unlikely, that Program 7 will undertake a project of this nature.
28.	Studies of the degradation of oil in oil-base mud-cuttings should be emphasized.	- Considerable work has been done in the past and is planned for this area of study.

29. Forecasting of wave and ice conditions is a priority for industry.

- The percentage of PERD 6.7 effort in this area reflects PERD's positive response to this priority.

30. Studies should focus on providing predictive tools and should concentrate on attempting to predict quantities that <u>are</u> predictable.

- Many of the projects currently underway emphasize this.

4.0 CONCLUDING REMARKS

The Background Document (Appendix A) for the Workshop will undoubtedly remain an important overview reference for several years to come. It accomplished its primary goal of setting a context for the Workshop in summarizing most of the ongoing environmental R&D in Canada's offshore waters.

The Workshop itself accomplished two major objectives: (i) it brought together government and industry scientists and managers into fora that saw research programs presented and critiqued in a constructive manner, and (ii) provided some thoughts and guidance to the PERD Task 6 Environment Committee that will enable the Committee to continue many of the widely supported research programs, while at the same time point out several research areas that could/should be supported in the future. As a secondary benefit the Workshop, through discussion at Calgary and through these proceedings, provided the opportunity to understand the workings and priorities of the PERD Environment Committee, and an opportunity to participants to influence the future direction of the Committee.

APPENDIX A

APPENDIX A

R-50

BACKGROUND DOCUMENT

ON

OFFSHORE ENVIRONMENTAL RESEARCH AND DEVELOPMENT IN CANADA

RELATED TO OIL AND GAS ACTIVITIES

REVISED VERSION

Prepared for

Environment Canada

on Behalf of the

Interdepartmental Panel on Energy Research and Development
Task 6: Conventional Energy Systems, Environment Committee

Prepared by

George D. Greene and David J. Thomas

March, 1985

PREAMBLE

This document does not present a complete listing of all environmental R&D related to offshore oil and gas activities in Canada. Limits to the scope of subject areas covered (imposed to allow the report to match the areas of interest of the PERD 6.7 Committee), and the non-availability of systematic data for some organizations involved in R&D, limit the comprehensiveness of the document. The report does, however, include most relevant research organizations and sources of funds, and it presents a good overview of offshore environmental reasearch and development in Canada. The coverage of the oil industry activities is not comprehensive, although the major companies involved in offshore environmental R and D did provide at the minimum overview data on their programs.

This document is an updated and revised version of the Background Document distributed at the Workshop on Offshore Environmental Research and Development in Canada Related to Oil and Gas Activities held in Calgary, February 11 and 12, 1985.

Notes to the Reader

The estimates of expenditures on R&D related to offshore oil and gas activities given in this report are subject to considerable uncertainty and should be used only as approximations. The uncertainties cannot be easily quantified on the basis of the level of budgetary detail available for the preparation of this document; they arise for the following reasons:

(a) some expenditures shown include salaries and other overhead factors, some do not;

(b) some expenditures shown include logistic and technical support, others do not. For example, CCRS includes all costs of airplanes, satellites, computing, salaries, etc. in their estimate of R&D expenditure whereas DFO costs generally exclude ship time and salaries;

(c) the impact of overlap of expenditures among the various PERD programmes occurs to an unknown extent;

(d) double counting of some research expenditures occurs. For example, CCRS includes funds it receives from other government departments and industry

for the provision of services in its R&D budget while the paying government departments and industry also include the expenditure to CCRS as part of their R&D expenditures.

(e) due to an incomplete response by the oil industry, industry R&D expenditures are highly underestimated;

(f) foreign participation in co-operative R&D programmes is not included in the expenditures shown. Contributions from the U.S. Office of Naval Research, the International Ice Patrol and the National Aeronautics and Space Administration and the National Oceanic and Atmospheric Administration (U.S) are definitely a valuable and significant addition to programmes run by AES and CCRS but are difficult to trace and quantify.

(g) substantial amounts of A-base resources are divided among various PERD subject areas and programmes but the split is seldom stated.

For the above reasons, any comparisons of the level of R&D expenditures among subject areas, funding sectors and geographic areas should be done with extreme caution.

The reader should also note the following points:

(a) ESRF expenditures are shown separately but are in fact an industry expenditure.

(b) NSERC expenditures are shown separately but are in fact a government expenditure.

(c) costs associated with Environmental Impact Statements are not considered valid R&D expenditures for the purposes of this document because most of these expenditures are used for literature surveys, compilations and re-working of existing data and consequently, do not qualify as R&D.

(d) operational monitoring has been included as valid R&D expenditures because in most cases the data collected for operational monitoring can be used for model verification and as such, cannot be distinguished from other R&D oceanographic data collection.

ACRONYMS USED IN THE BACKGROUND DOCUMENT

AOGA	Alaskan Oil and Gas Association
AOL	Atlantic Oceanographic Laboratory of DFO at BIO
APOA	Arctic Petroleum Operators Association
BIO	Bedford Institute of Oceanography, Dartmouth
COGLA	Canada Oil and Gas Lands Administration
DRIE	Department of Regional and Industrial Expansion
EC	Environment Canada
EC/CPG	EC Coporate Planning Group
EC/AES	EC Atmospheric Environment Service
EC/CWS	EC Canadian Wildlife Service
EMR	Department of Energy, Mines and Resources
EMR/CCRS	EMR Canada Centre for Remote Sensing
EC/EPS	EC Environmental Protection Service
ESRF	Environmental Studies Revolving Funds (INAC AND COGLA)
DFO	Department of Fisheries and Oceans
DFO/AFS	DFO Atlantic Fisheries Service
DFO/OSS	DFO Ocean Science and Surveys
DFO/MSID	DFO Marine Sciences and Information Directorate
DFO/BL	DFO Bayfield Laboratory, Burlington
DFO/IOS	DFO Institute of Ocean Sciences, Sidney
DFO/NWTIFM	DFO NWT and Inland Fishery Management
DFO/SFI	DFO Services to the Fishing Industry
INAC	Indian and Northern Affairs Canada
IOS	Institute of Ocean Sciences, Sidney, B.C.
MEL	Marine Ecology Laboratory of DFO at BIO
NOGAP	Northern Oil and Gas Action Plan
NRC	National Research Council
NSERC	National Science and Engineering Research Council of Canada
OERD	Office of Energy R and D, EMR
OOD/CPA	Offshore Operators Division, Canadian Petroleum Association
PERD	Federal Interdepartmental Panel on Energy R&D
PWC	Public Works Canada
SPCNRDP	Senior Policy Committee, Northern Resource Development Projects
TC	Transport Canada

TABLE OF CONTENTS
BACKGROUND DOCUMENT ON OFFSHORE ENVIRONMENTAL R AND D IN CANADA
PERD TASK 6 ENVIRONMENT COMMITTEE

		Page
PREAMBLE		A-3
ACRONYMS USED IN THE REPORT		A-5
TABLE OF CONTENTS		A-6
1.	INTRODUCTION	A-9
	1.1 Document Objectives	A-9
	1.2 Scope	A-9
	1.3 Summary of Canadian Resources Committed to Offshore Environmental R and D	A-10
2.	INTERDEPARTMENTAL RESEARCH AND DEVELOPMENT FUNDS	A-26
	2.1 PERD (Interdepartmental Panel on Energy R and D)	A-27
	2.2 ESRF (Environmental Studies Revolving Funds)	A-40
	2.3 NOGAP (Northern Oil and Gas Action Plan)	A-48
3.	FEDERAL DEPARTMENTS A-BASE RESEARCH AND DEVELOPMENT	A-53
	3.1 Canada Oil and Gas Lands Administration	A-54
	3.2 Environment Canada	A-55
	3.2.1 Atmospheric Environment Service	A-55
	3.2.2 Canadian Wildlife Service	A-57
	3.2.3 Environmental Protection Service	A-57
	Arctic Marine Oilspill Program (AMOP)	A-57
	EPS Atlantic Region, Dartmouth	A-60
	EPS Western and Northern Region, Yellowknife	A-60

TABLE OF CONTENTS, cont'd

		Page
3.3	Energy, Mines and Resources	A-61
3.3.1	Canada Centre for Remote Sensing (CCRS)	A-61
3.3.2	Office of Energy Research and Development (OERD)	A-61
3.4	Department of Fisheries and Oceans	A-62
3.4.1	Ocean Science Affairs Branch	A-62
3.4.2	Marine Environmental Data Services Branch (MEDS)	A-62
3.4.3	Fisheries Research Branch - St. John's	A-63
3.4.4	Bedford Institute of Oceanography (BIO)	A-65
3.4.5	St. Andrews Biological Station, New Brunswick	A-71
3.4.6	Freshwater Institute (FWI), Winnipeg	A-71
3.4.7	Institute of Ocean Sciences, Sidney	A-73
3.5	Indian and Northern Affairs Canada	A-77
3.5.1	Environmental Studies Division, Northern Environment	A-77
3.5.2	Beaufort Environmental Monitoring Program (BEMP)	A-78
3.6	National Sciences and Engineering Research Council of Canada (NSERC)	A-81
4.	PROVINCIAL DEPARTMENTS RESEARCH AND DEVELOPMENT	A-86
4.1	Newfoundland and Labrador Petroleum Directorate	A-87
4.2	Government of Nova Scotia	A-90
4.3	Government of British Columbia	A-90

TABLE OF CONTENTS, cont'd

		Page
5.	OIL INDUSTRY RESEARCH AND DEVELOPMENT	A-94
	5.1 Mobil Oil Canada, Ltd.	A-95
	5.2 Petro-Canada Resources	A-99
	5.3 Husky Oil	A-99
	5.4 Esso Resources Canada Limited	A-100
	5.5 Dome Petroleum Limited	A-102
	5.6 Gulf Canada Resources Inc.	A-105
	5.7 Panarctic Oils Ltd.	A-106
	5.8 Arctic Petroleum Operators Association (APOA)	A-108
	5.9 Summary of Industry R and D in the Beaufort Sea Region	A-109
6.	OTHER OFFSHORE ENVIRONMENTAL RESEARCH AND DEVELOPMENT	A-110
	6.1 Centre for Cold Ocean Resources Engineering (C-CORE)	A-111
7.	LITERATURE CITED	A-113

1. INTRODUCTION

1.1 DOCUMENT OBJECTIVES

The federal Interdepartmental Panel on Energy Research and Development, (PERD) 6.7 (Environment) Committee is currently reviewing its areas of interest and priorities for funding of environmental R and D related to offshore oil and gas activities. This review is in response to a request from the Panel that each program committee develop a ranking of projects in order of importance to meeting its program objectives.

This document provides an overview of relevant offshore environmental R and D being conducted in Canada. The document is intended to assist the 6.7 Committee in considering the objectives, roles and priorities for its funding in the context of other relevant research and development programs and funding sources, including other interdepartmental funds, federal and provincial resources and oil industry research efforts.

1.2 SCOPE

The PERD 6.7 Committee uses the following subject areas to define its interests in offshore R and D:

PERD 6.7.1 Offshore Forecasting/Oceanography

- Weather
- Waves and Currents
- Sea Ice and Icebergs

PERD 6.7.2 Offshore Environmental Impacts

- Ecological Studies (effects, modelling)
- Monitoring Methodologies and Techniques
- Waste Treatment Technologies
- Oilspill Studies

Other subject areas relevant to offshore oil and gas activities are addressed by other PERD Task 6 committees (6.1 Geoscientific R and D; 6.2 Marine Engineering; 6.3 Offshore Geotechnics; 6.5 Materials for Offshore Structures; and 6.6 Transportation of Oil and Gas).

This report focusses on the R and D subject areas defined above. However, closely related research, particularly that involving marine engineering which depends on physical environment data, is also listed in the report. In reviews of other interdepartmental funds, such as NOGAP and ESRF, only research which falls into the above scope or is closely related is discussed in the report.

1.3 SUMMARY OF CANADIAN RESOURCES COMMITTED TO OFFSHORE R AND D

The following figures and tables show the breakdown of Canadian R and D resources applied in 1984/1985 to offshore environmental R and D relevant to PERD 6.7. The data show distribution of funds by sector (federal government, provincial government, industry and university), by region and by subject area.

TABLE 1-1

1984/85 ESTIMATED TOTAL CANADIAN OFFSHORE ENVIRONMENTAL R AND D - BY FUNDING SECTOR (Subjects Relevant to PERD 6.7)

FUNDING SECTOR	$K	(P-Y)
PERD 6.7	6,657	(8.5)
NOGAP	1,172	(9.8)
ESRF (1984)	2,770	
Federal Departments (A-Base and other, excluding PERD, NOGAP, ESRF)	16,377	(151)
Provincial Governments	85	
University[1]	1,917	
Industry (includes C-CORE non-recovered, core funding)	18,884	(42)[2]
TOTAL	**47,862**	**(211)**

1. University R and D is NSERC operating and strategic grants (federal monies)

2. Industry $K and p-y are an underestimate; some companies did not report expenditures; industry includes a portion of marine engineering R and D applied to development of design criteria.

NOTE: 84/85 used for federal agencies, PERD, NOGAP and NSERC; 83/84 used for DFO/BIO; 1985 used for industry.

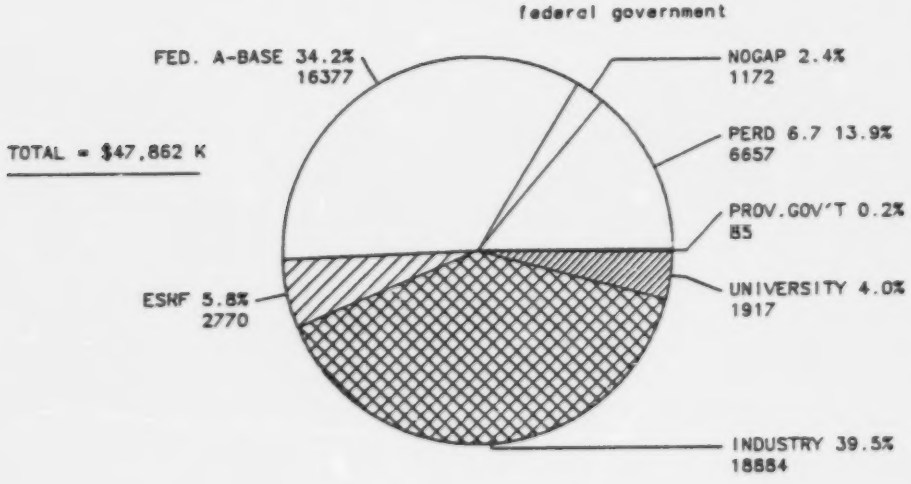


FIGURE 1-1. 84/85 Estimated Total R and D by Funding Sector ($K) Subjects Relevant to PERD 6.7.

TABLE 1-2A

1984/85 ESTIMATED TOTAL CANADIAN OFFSHORE ENVIRONMENTAL R AND D - BY SUBJECT AREA (Subjects Relevant to PERD 6.7)

SUBJECT AREA	$K
Weather and Climate	1,872
Waves and Currents	3,671
Oceanography[1]	10,887
Sea Ice and Icebergs	10,825
Ecological Studies	4,295
Waste Treatment/Control Technologies	254
Monitoring (Effects) and Technology Development	2,433
Oilspill Studies	3,739
Remote Sensing	8,952
Other	35
Data Management	704
Administration	195
TOTAL	47,862

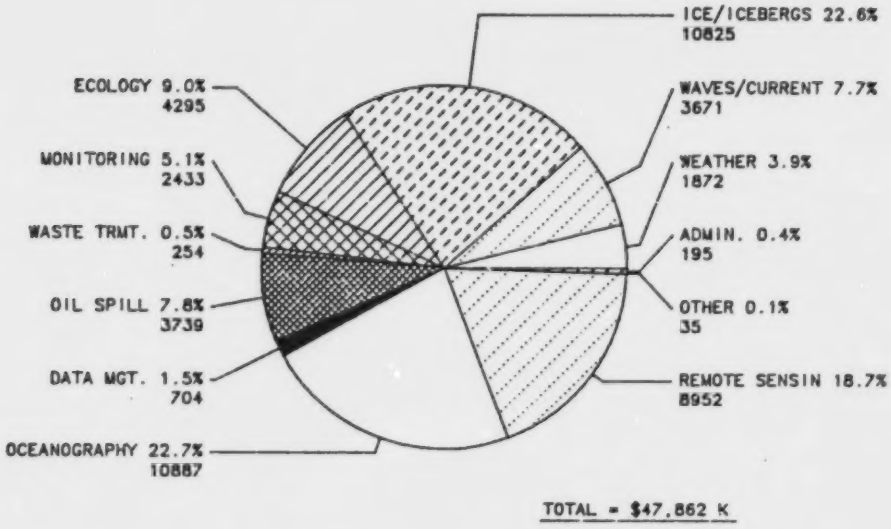
[1] oceanographic process R and D, operational monitoring by industry, studies to develop oceanographic design criteria, and hydrography

TABLE 1-2B

1984/85 PERD TASK 6.7 EXPENDITURES BY SUBJECT AREA ($K) (All Departments)

SUBJECT AREA	DEPARTMENT			
	DFO	EC	EMR	TOTAL
Weather/Climate	79	137	0	216
Waves and Currents	721	521	0	1,242
Sea Ice and Icebergs	1,808	732	0	2,540
Ecological Studies	749	48	0	797
Monitoring and Techniques	657	404	190	1,251
Waste Treatment/Control Technologies	0	215	0	215
Oilspill Studies	0	284	0	284
Data Management	112	0	0	112
TOTAL	4,126	2,341	190	6,657

Figure 1-2. 84/85 Estimated Total R and D by Subject Area ($K)
Subjects Relevant to PERD 6.7.



1984/85 PERD 6.7 Funds by Subject Area ($K)
All Departments

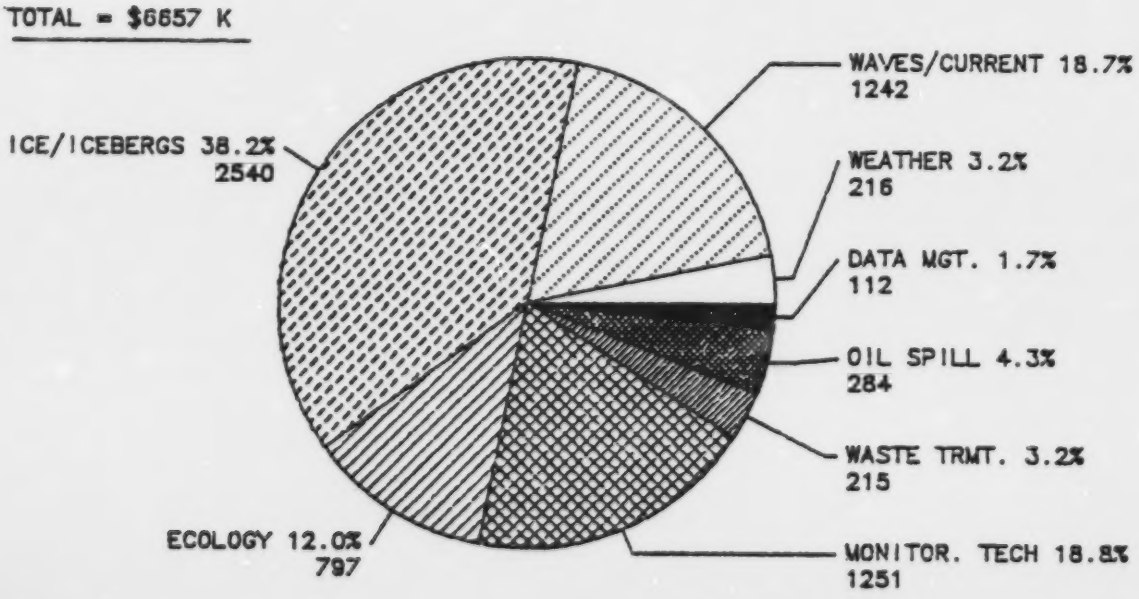


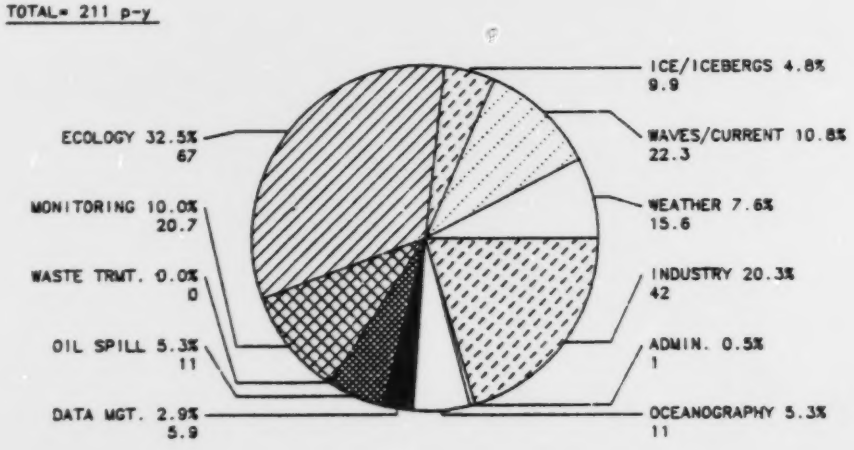
TABLE 1-3

1984/85 ESTIMATED TOTAL CANADIAN PERSONNEL RESOURCES APPLIED TO OFFSHORE ENVIRONMENTAL R AND D (P-Y) (Subjects Relevant to PERD 6.7)[1]

SUBJECT AREA	p-y
Weather and Climate	15.6
Waves and Currents	22.3
Oceanography[2]	11.0
Sea Ice and Icebergs	9.9
Ecological Studies	67.0
Waste Treatment/Control Technologies	0.0
Monitoring (Effects) and Technology Development	20.7
Oilspill Studies	11.0
Other (mostly remote sensing)	4.6[3]
Data Management	5.9
Administration	1.0[4]
Other (industry p-y not assigned by subject area)	42.0
TOTAL	**211.0**

1. this table is not comprehensive; some federal departments and some companies did not report p-y.
2. oceanographic process; operational monitoring; some design criteria
3. salary included in expenditure ($K) table; p-y provided for C-Core only
4. this value highly suspect; comprises only EMR/OERD

Figure 1-3. 84/85 Estimated Total Personnel by Subject Area* (P-Y).



* remote sensing p-y for C-Core only.
CCRS p-y included in $K

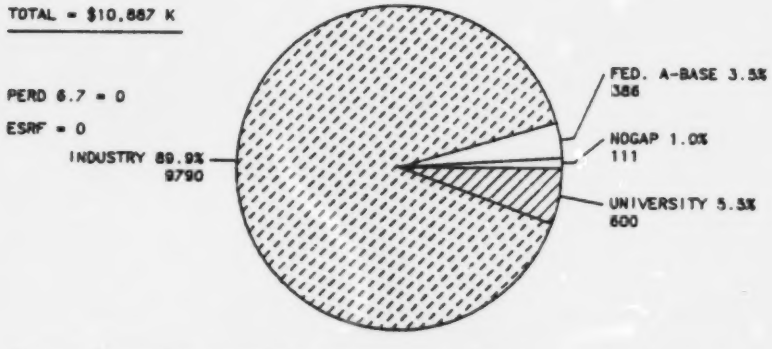
TABLE 1-4

1984/85 R AND D EXPENDITURES ON NON SPECIFIED OCEANOGRAPHY - BY FUNDING SECTOR (Subjects Relevant to PERD 6.7)[1]

FUNDING SECTOR	$K
PERD 6.7	0
NOGAP	111
ESRF	0
Federal Departments (A-Base)	386
University	600
Industry	9,790
TOTAL	**10,887**

[1] oceanographic process R and D; operational monitoring by industry; studies to develop oceanographic design criteria.

Figure 1-4. 84/85 R and D Expenditure on Non Specified Oceanography ($K) by Funding Sector*.



* ocean. process; operational monitoring; ocean. design criteria

TABLE 1-5

1984/85 SEA ICE AND ICEBERG R AND D - BY FUNDING SECTOR (Subjects Relevant to PERD 6.7)

FUNDING SECTOR	$K
PERD 6.7	2,540
NOGAP	40
ESRF	699
Federal Departments	386
Provincial Governments	25
University	474
Industry	6,661
TOTAL	**10,825**

Figure 1-5. 84/85 R and D Expenditure on Sea Ice and Icebergs ($K) by Funding Sector.

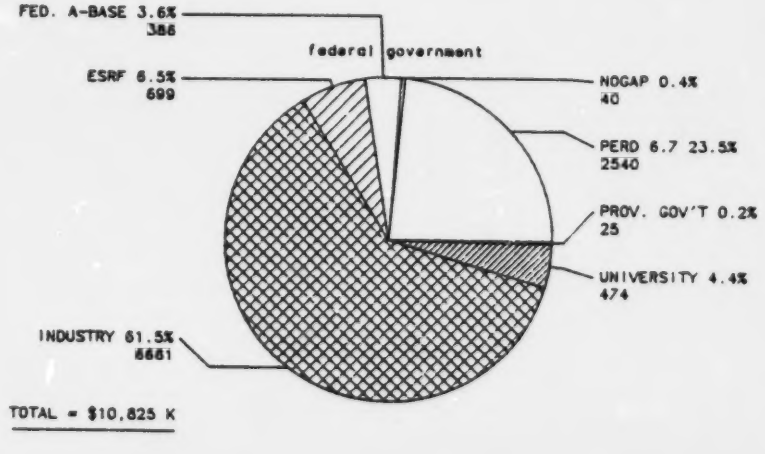


TABLE 1-6

1984/85 MARINE ECOLOGY R AND D - BY FUNDING SECTOR
(Subjects Relevant to PERD 6.7)

FUNDING SECTOR	$K
PERD 6.7	797
NOGAP	488
ESRF	570
Federal Departments	1,765
Provincial Governments	0
University	625
Industry	50[1]
TOTAL	4,295

1 excludes expenditures for preparation of EIS for development review and approvals

Figure 1-6. 84/85 R and D Expenditures on Marine Ecology ($K) by Funding Sector.

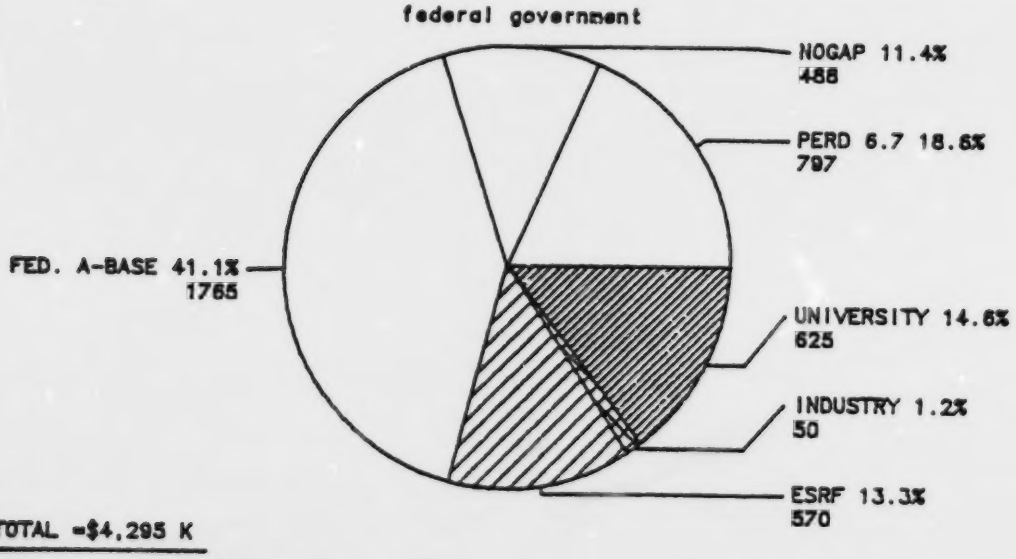


TABLE 1-7

1984/85 OILSPILL R AND D - BY FUNDING SECTOR
(Subjects Relevant to PERD 6.7)

FUNDING SECTOR	$K
PERD 6.7	284
NOGAP	20
ESRF	1,109
Federal Departments	1,227
Provincial Governments	20
University	129
Industry	950
TOTAL	**3,739**

Figure 1-7. 84/85 R and D Expenditures on Oilspill ($K) by Funding Sector.

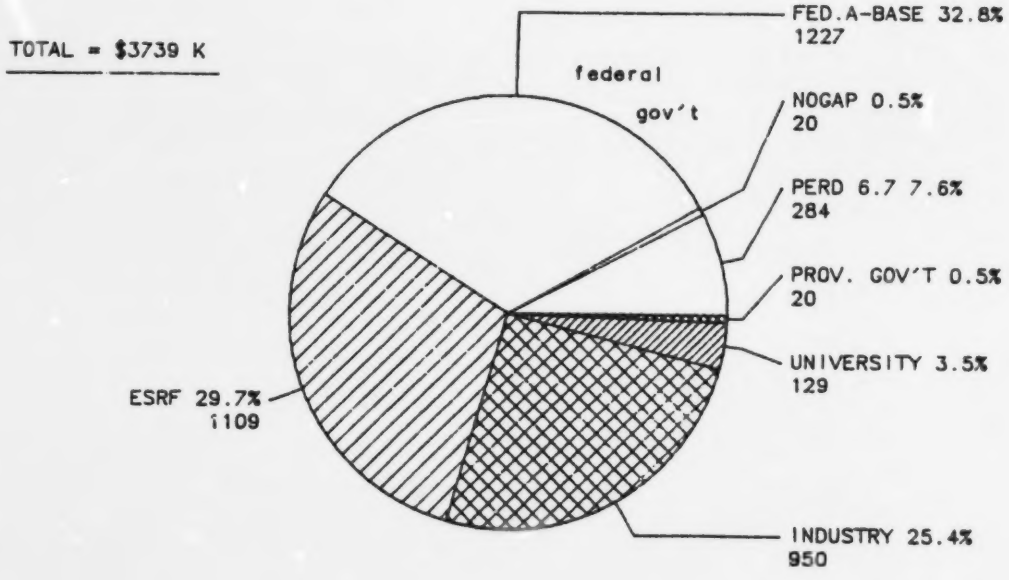


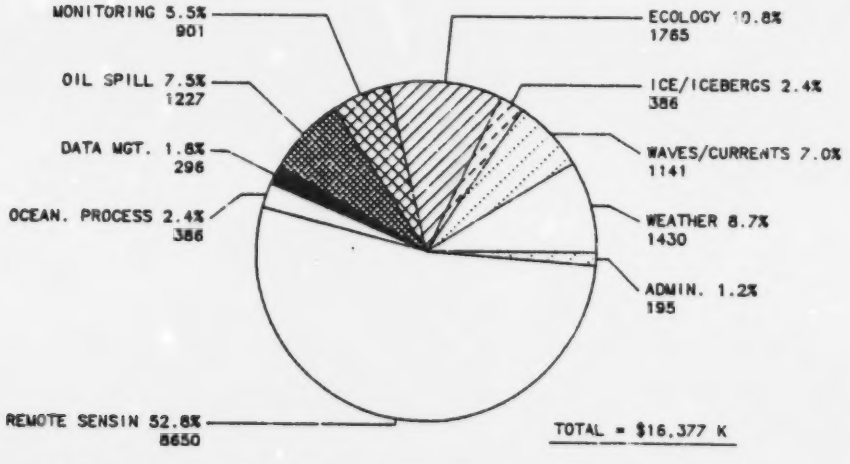
TABLE 1-8

1984/85 FEDERAL GOVERNMENT[1] OFFSHORE ENVIRONMENTAL R AND D EXPENDITURES - BY SUBJECT AREA - $K (P-Y)
(Subjects Relevant to PERD 6.7)

SUBJECT AREA	TOTAL	DFO	EC	EMR
Weather/Climate	1430 (13.5)	593 (3)	835 (10.5)	0
Waves and Currents	1141 (21.3)	1139 (21.3)	2	0
Oceanographic Processes	386 (10)	386 (10)	0	0
Sea Ice and Icebergs	386 (3.7)	126 (3.7)	260	0
Ecological Studies[2]	1765 (63.5)	1479 (57.8)	286 (5.7)	0
Monitoring (Effects) and Technology Development	901 (19.7)	836 (17.6)	65 (2.1)	0
Oilspill Studies	1227 (10.9)	298 (6.2)	929 (4.7)	0
Data Management	296 (3.7)	296 (3.7)	0	0
Remote Sensing	8650	0	0	8650[3]
Administration	195 (1)	120[3]	0 (1)	75
TOTAL	16,377 (147)[2]	5,273 (123)	2,377 (24)	8,725 (0)

1 A-Base and other; excludes PERD, NOGAP, ESRF:
2 INAC has 3 p-y (included in total); INAC R and D funded by NOGAP (ESRF also addresses INAC R and D needs)
3 includes salary

Figure 1-8. 84/85 Federal Government R and D ($K) by Funding Area.



*A-Base and other; excludes PERD, NOGAP, ESRF

TABLE 1-9

1984 INDUSTRY OFFSHORE ENVIRONMENTAL R AND D EXPENDITURES - BY SUBJECT AREA[1] (Subjects Relevant to PERD 6.7)

SUBJECT AREA	$K
Weather/Climate	included in Oceanography below
Waves and Currents	670
Oceanography[2]	4,140
Operational Monitoring	5,650
Sea Ice and Icebergs	5,270 + 1,391[3]
Ecological Studies	50[4]
Monitoring (Effects) and Technology Development	160
Oilspill Studies	950
Data Management	150 + 96[3]
Remote Sensing	302[3]
Waste Treatment	20
Other	35
TOTAL	18,884

1 Totals are underestimated; some companies did not report expenditures

2 Includes environmental data collection and analysis for development of design criteria

3 C-CORE base funding from industry

4 excludes studies done as part of EIA for development approvals

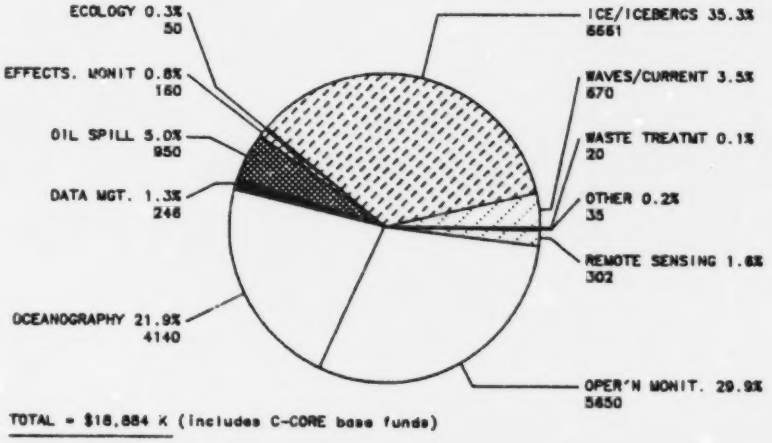


Figure 1-9. 1985 Industry R and D by Subject Area ($K) Subjects Relevant to PERD 6.7.

TABLE 1-10

1984/85 TOTAL CANADIAN OFFSHORE ENVIRONMENTAL R AND D BY REGION (Subjects Relevant to PERD 6.7)

REGION	$K
East Coast[1]	10,682
West Coast	735
Arctic[2]	18,606
Not Specified or General Application	17,842
TOTAL	**47,862**

1 includes Labrador Coast and Gulf of St. Lawrence

2 Beaufort Sea and High Arctic

Figure 1-10. 84/85 Estimated Total R and D by Region ($K) Subjects Relevant to PERD 6.7.

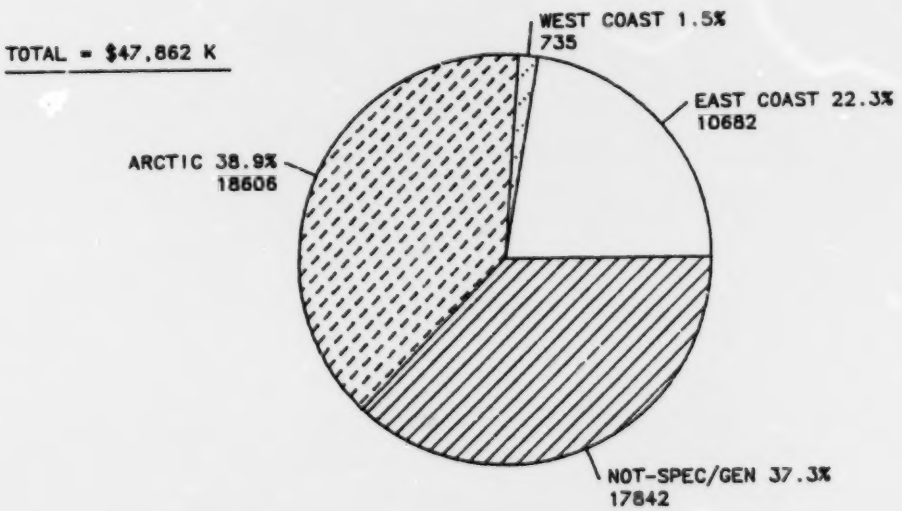
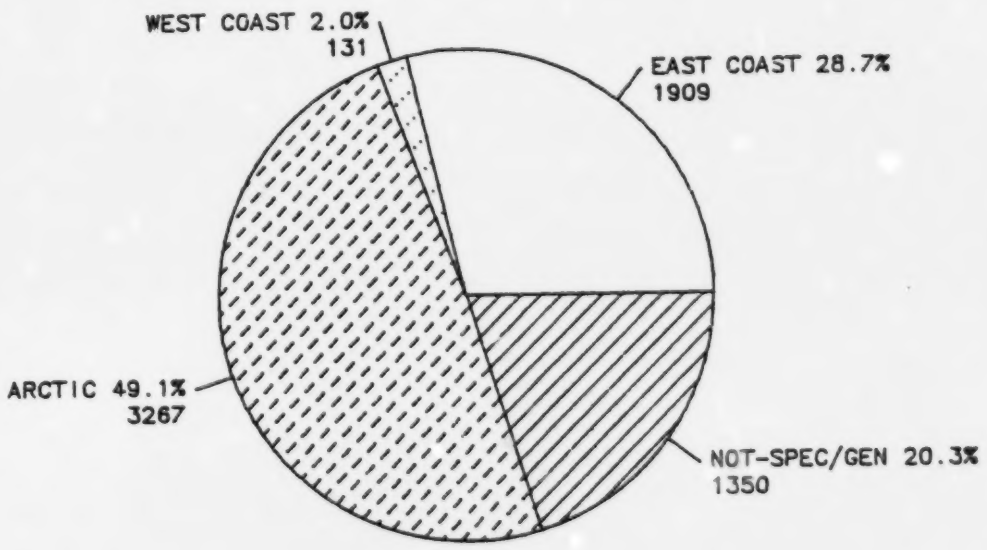


TABLE 1-11

1984/85 PERD 6.7 EXPENDITURES BY REGION ($K)
(All Departments)

REGION	DFO	EC	EMR	TOTAL
East Coast	926	983	0	1,909
West Coast	131	0	0	131
Arctic	3,041	226	0	3,267
Not-Specified or General Applicability	28	1,132	190	1,350
TOTAL	**4,126**	**2,341**	**190**	**6,657**

Figure 1-11. 1984/85 PERD 6.7 Expenditures by Region ($K)
All Departments



TOTAL = $6,657 K

TABLE 1-12

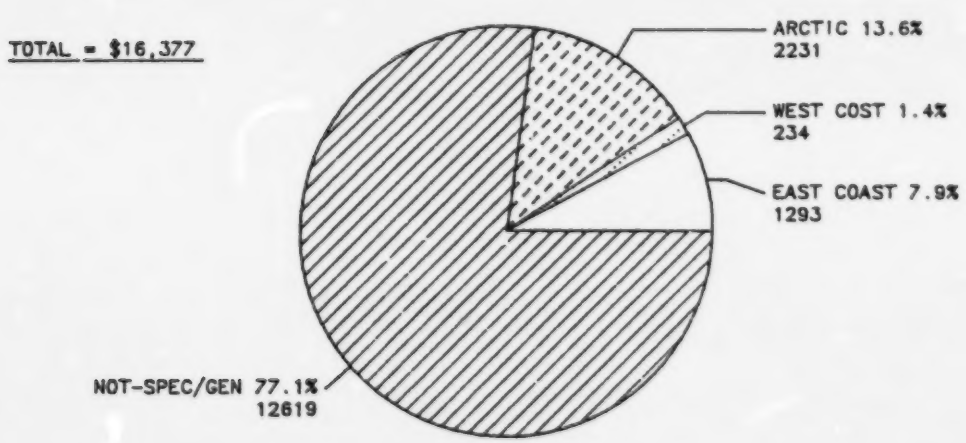
1984/85 FEDERAL GOVERNMENT[1] OFFSHORE ENVIRONMENTAL R AND D BY REGION (Subjects Relevant to PERD 6.7)

REGION	$K	(P-Y)
East Coast	1,293	(26.4)
West Coast	234	(3.2)
Arctic	2,231	(40.9)
Not Specified or General Applicability	12,619	(76.5)
TOTAL	**16,377**	**(147)**

1 A-Base and other sources; excludes PERD, NOGAP and ESRF

Note: A portion of the above totals (about $9,000 K) includes salary

Figure 1-12. 84/85 Federal Government R and D by Region ($K) Subjects Relevant to PERD 6.7.



• A-Base and other; excludes PERD, NOGAP, ESRF

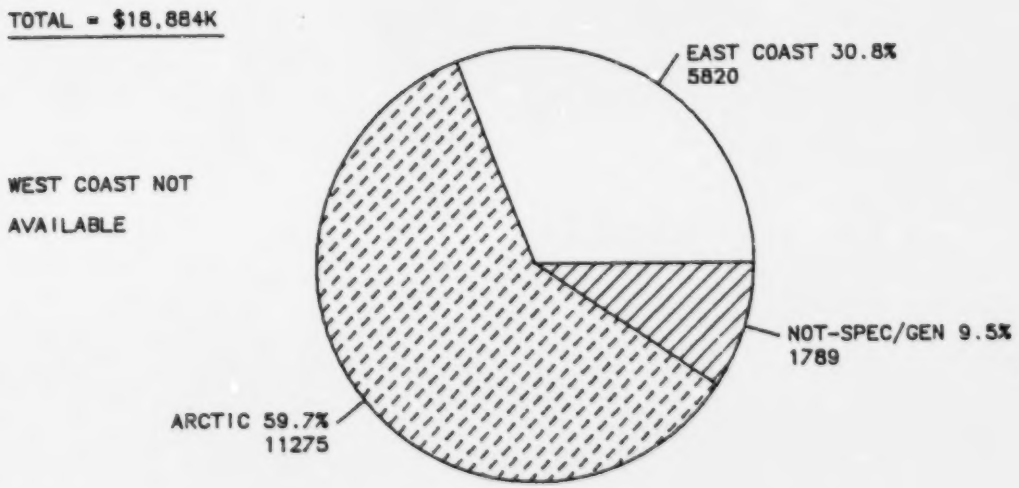
TABLE 1-13

1984 INDUSTRY OFFSHORE ENVIRONMENTAL R AND D BY REGION[1] (Subjects Relevant to PERD 6.7)

REGION	$K
East Coast	5,820
West Coast	N/A
Arctic	11,275
Not Specified or General Application	1,789
TOTAL	**18,884**

1 listing is not comprehensive; some companies did not report expenditures.

Figure 1-13. 1984 Industry R and D by Region ($K)* Subjects Relevant to PERD 6.7.



* listing incomplete

Figure I-14A. PERD 6.7 Funds by Year and Subject Area ($K)

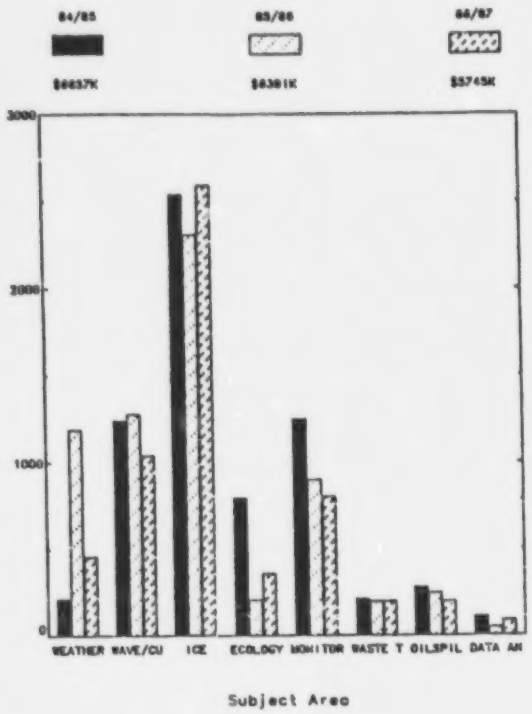


Figure I-14B. ESRF Expenditures by Year and Subject Area ($K) Subjects Relevant to PERD 6.7.

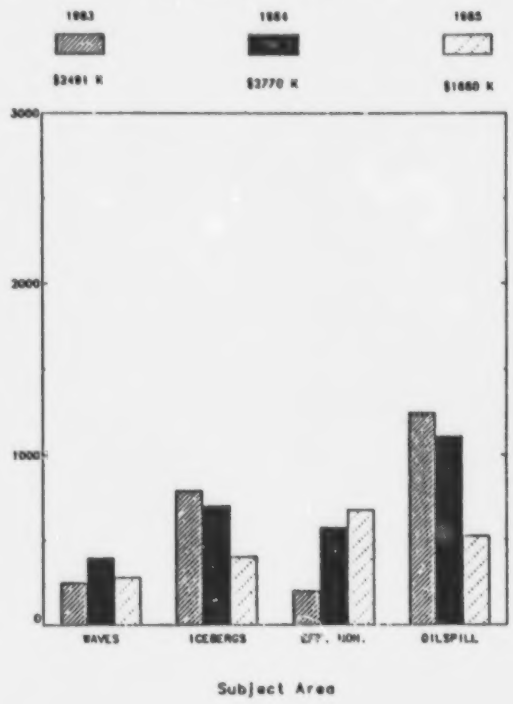
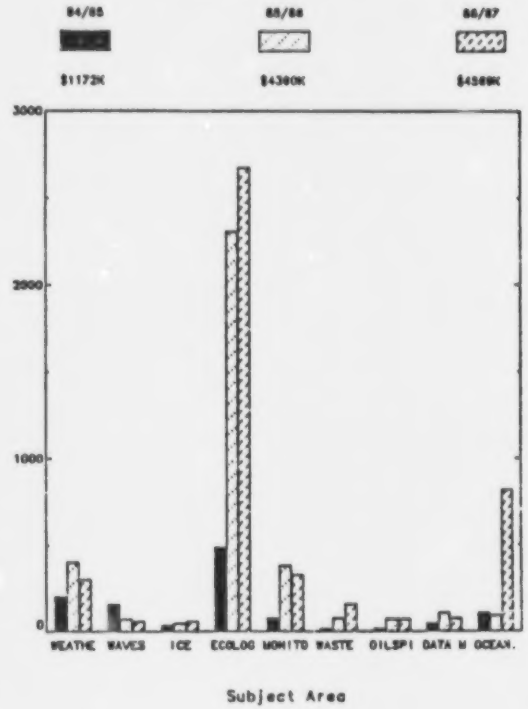


Figure I-14C. NOGAP Proposed Funds by Year and Subject Area ($K) Subjects Relevant to PERD 6.7.



2. INTERDEPARTMENTAL RESEARCH AND DEVELOPMENT FUNDS

2.1 PERD (INTERDEPARTMENTAL PANEL ON ENERGY R AND D)

Objectives

The primary purpose of the R and D conducted under PERD Task 6 (Conventional Energy Systems - Oil, Gas, Electricity) is to provide the federal government with a technical basis to meet its responsibilities. The government responsibilities which are supported by PERD funding are (OERD 1984):

(1) To regulate oil and gas developments, particularly in Canada Lands

(2) To provide forecasting, and hydrographic charting for operations in the Canada Lands

(3) To provide a regional understanding of environmental and geotechnical processes in the Canada Lands

(4) To evaluate national hydrocarbon reserves and resources for policy purposes

(5) To assist Canadian supply and service industries to be competitive

(6) To establish national standards.

The objective of PERD 6.7 (Environment) funding is to improve forecasting of sea, ice and weather conditions; and to improve understanding of environmental processes within the context of offshore oil and gas activities. PERD 6.7 has focussed its attention almost exclusively on offshore environments.

Structure

The seven Taskss into which PERD is divided are shown in Figure 2-1. Funding distributions and priority and distribution of 1984-85 funds are shown in Figures 2-3 and 2-4 respectively. Task 6 is further divided into 8 sub-Tasks (Figure 2-2). Each sub-Task has a Committee which sets research priorities, reviews proposals and recommends funding for projects to the Task Coordinating Committee and then to the Interdepartmental Panel. These Committees have members from relevant federal departments, industry, universities and in some cases provincial research agencies. The membership for PERD 6.7 (Environment) is given in Table 2-1. Task 6.2, Marine Engineering, also funds some research which is relevant to PERD 6.7.

PERD 6.7 has two program areas:
- Environmental Forecasting (6.7.1)
- Environmental Impacts (6.7.2)

PERD 6.2 has three program areas:
- Environmental Design Criteria (6.2.1)
- Safety Technology (6.2.2)
- Marine Structures Engineering (6.2.3)

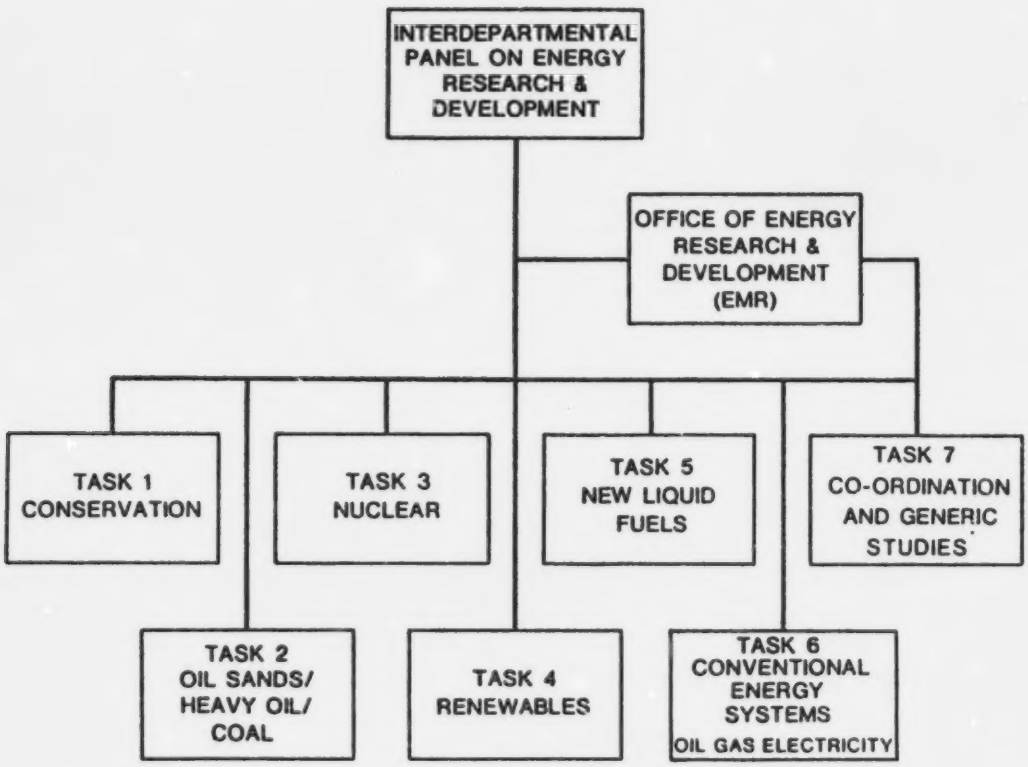

INTERDEPARTMENTAL PANEL ON ENERGY RESEARCH & DEVELOPMENT
OFFICE OF ENERGY RESEARCH & DEVELOPMENT (EMR)
TASK 1 CONSERVATION
TASK 3 NUCLEAR
TASK 5 NEW LIQUID FUELS
TASK 7 CO-ORDINATION AND GENERIC STUDIES
TASK 2 OIL SANDS/ HEAVY OIL/ COAL
TASK 4 RENEWABLES
TASK 6 CONVENTIONAL ENERGY SYSTEMS
OIL GAS ELECTRICITY

Figure 2-1. Federal Energy Research and Development Co-ordinating Structure.

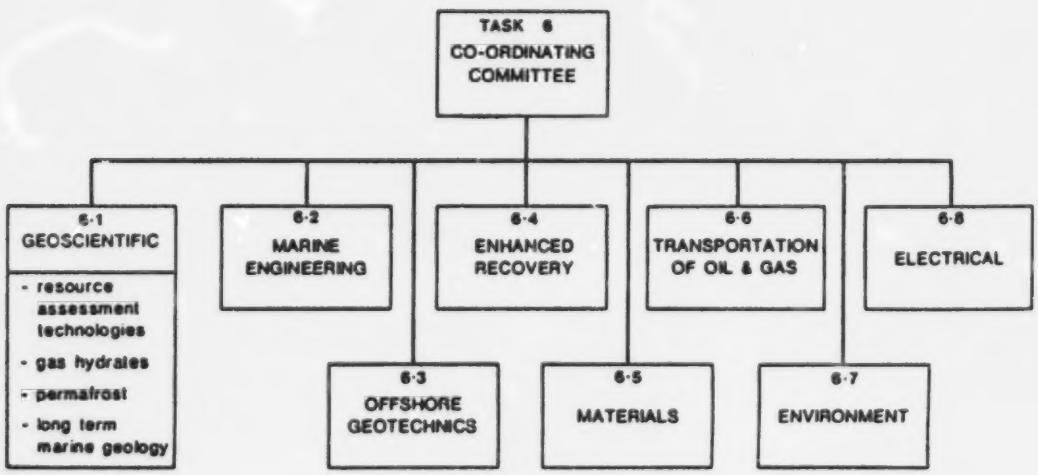


Figure 2-2. Conventional Energy Systems Task - Committee Structure.

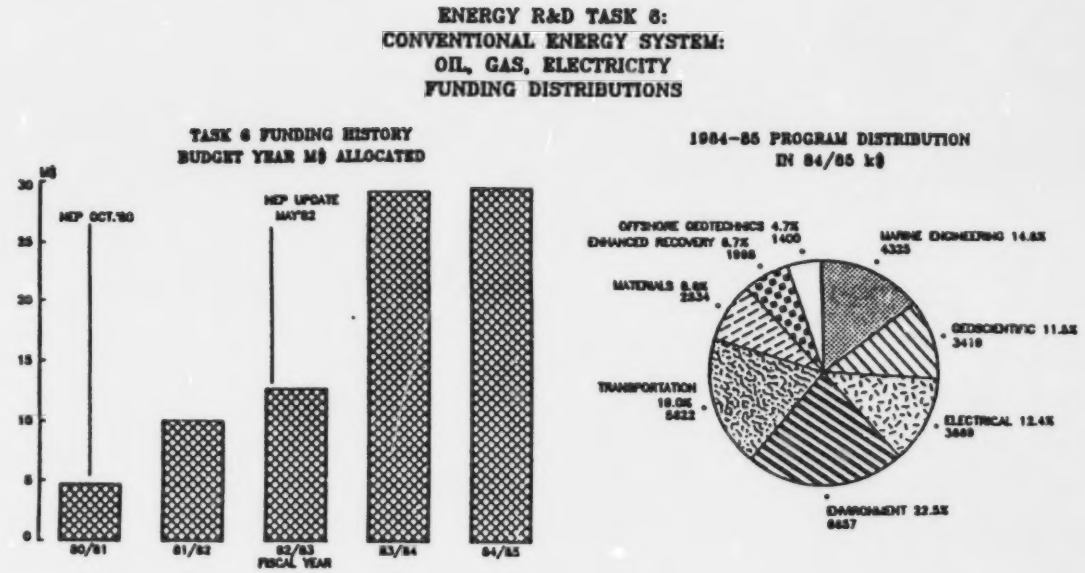


Figure 2-3. Energy R&D Task 6. Conventional Energy System: Oil, Gas, Electricity. Funding Distributions.

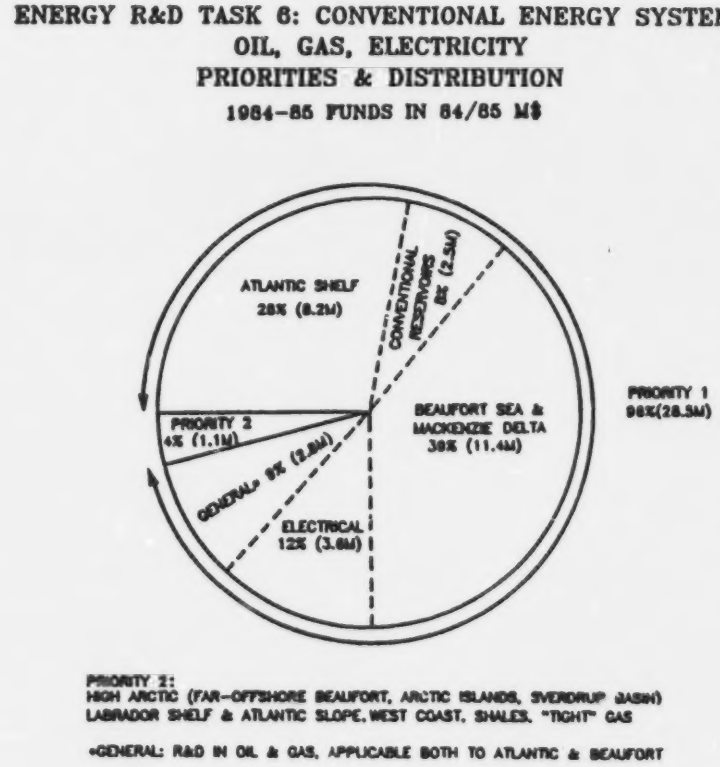


Figure 2-4. Energy R&D Task 6. Conventional Energy Systems. Oil, Gas, Electricity. Priorities & Distribution.

Table 2-1

TASK 6.7 (ENVIRONMENT) COMMITTEE

Wayne Richardson (Co-Chairman), EC/CPG,Ottawa
Dick Stoddart (Co-Chairman), F&O, Ottawa
Langley Muir, COGLA, Ottawa
Rainer Engelhardt, COGLA, Ottawa
David Stone, INAC, Ottawa
Betty Ann Balfour, EMR, Ottawa
John Mitchell, TC, Ottawa
Wayne Speller, CPA/OOD (and Petro-Canada Resources, Calgary)
Ed Pessah, APOA (and Dome Petroleum Limited, Calgary)
Gaston Paulin, EC/AES
Doug McKone, F&O/AFS Kelly Karr, EC/EPS
J.P. Hea (Task 6 Coordinator), EMR, Ottawa
Bryan Cook (OERD Desk Officer), EMR, Ottawa

Links

There are several informal links between PERD Task 6 and other sources of offshore R and D funding in Canada. A number of these are listed below.

(1) PERD and NOGAP exchange listings of proposed projects and PERD reviews NOGAP proposals to prevent duplication.

Bryan Cook (OERD Task 6 Desk Officer) is a member of the NOGAP Committee of Coordinators. Ruth Rodger (Senior Planning Coordinator, NOGAP) is a member of the PERD Task 6 Coordinating Committee.

Dr. Whitham, Chairman of PERD is a member of SPCNRD to which the NOGAP Coordinator reports.

(2) PERD and the ESRF exchange listings of proposed projects.

Maurice Ruel, Chairman of ESRF (COGLA) is Chairman of the PERD Task 6.2 Committee.

M. Taschereau, COGLA Administrator is a member of PERD.

At the project level, at least one researcher or research manager involved with PERD Task 6 is a member of or scientific advisor to each relevant ESRF Program Study Committee.

Program Funding

PERD 6.7 is divided into two sub-programs, each of which has a number of study topics.

6.7.1	Environmental Forecasting:	1) Weather 2) Waves and Currents 3) Sea Ice and Icebergs
6.7.2	Environmental Impacts:	4) Ecological Studies (effects, modelling) 5) Monitoring Methodologies and Techniques 6) Waste Treatment 7) Oil Spill Studies.

The distribution of PERD 6.7 funds by subject area and by region is shown in Figures 2-5 and 2-6, respectively (DFO only). Table 2-2 provides five-year estimates for all currently funded 6.7 and 6.2 projects. The 6.2 projects are also listed because of the overlap that can occur between 6.2 and 6.7 projects.

Table 2.3 and Figure 2-7 show the allocation of all PERD 6.7 funds for the fiscal periods 84/85 through 88/89 by subject area. Also shown are the current and projected R&D expenditures (84/85 - 88/89) on PERD 6.7 by the three departments which receive these funds: The Department of Fisheries and Oceans (Table 2-4), Environment Canada (Table 2-5) and the Department of Energy, Mines and Resources (Table 2-6). Data for 1984/85 are presented graphically in Figure 2-8.

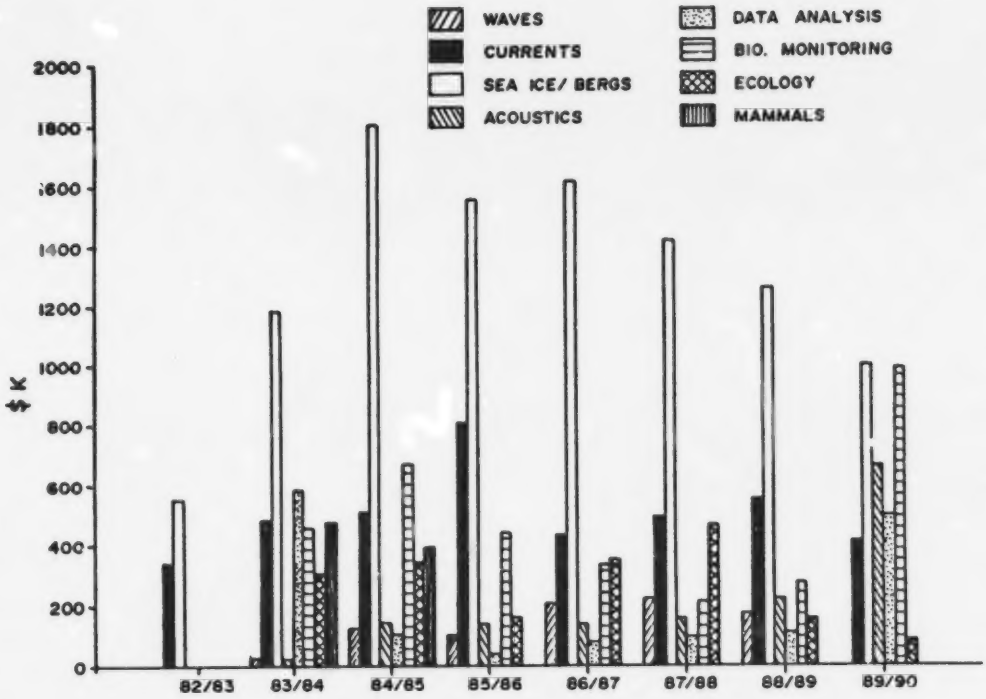


Figure 2-5. Environment Committee/DFO Projects by Subject Area Relevant to PERD 6.7.

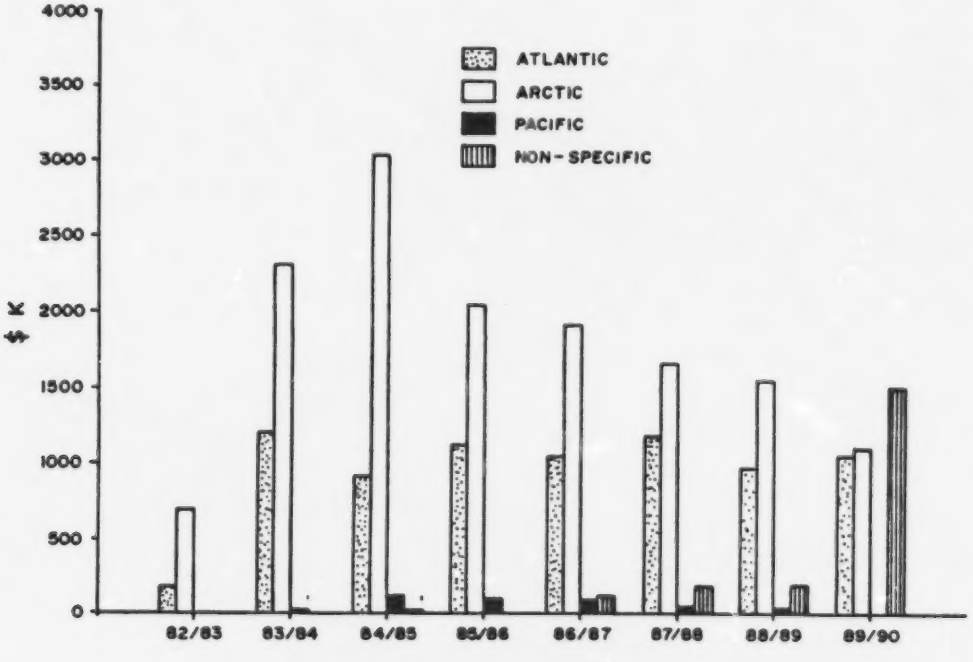


Figure 2-6. Environment Committee/DFO Projects by Ocean Area Relative to PERD 6.7.

TABLE 2-2
ENERGY R & D RESOURCES
REPORT BY ALL TASKS/PROGRAMS/SUBPROGRAMS
1984/85 RL K$ (P-Y)

TASK: 6 CONVENTIONAL ENERGY SYSTEMS - OIL, GAS, ELECTRICITY

Code	Prog/Subprog/Project	Dept/P.E.	84-85	85-86	86-87	87-88	88-89
67	ENVIRONMENT						
671	Environment Forecasting						
67101	Marine Weather Forecast East Coast	EC/AES	53 (0.0)	135 (0.0)	145 (0.0)	145 (0.0)	135 (0.0)
67102	Aviation Weather Prediction	EC/AES	84 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
67103	H.F. Radar	FO/OSS	105 (0.0)	90 (0.0)	100 (0.0)	105 (0.0)	115 (0.0)
67104	Waves and Sea State Prediction	EC/AES	521 (1.5)	275 (1.5)	305 (1.5)	305 (1.5)	325 (1.5)
67105	N.W. Passage Numerical Modelling	FO/OSS	105 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
67106	Surface Current Prediction	FO/OSS	105 (0.0)	100 (0.0)	100 (0.0)	105 (0.0)	115 (0.0)
67107	Arctic Oceanography	FO/OSS	84 (0.0)	50 (0.0)	70 (0.0)	75 (0.0)	105 (0.0)
67108	Continuous Current Profiler	FO/OSS	135 (0.0)	140 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
67109	Mooring Material	FO/OSS	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
67110	Bio Image Analysis System	FO/OSS	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
67111	Oceanographic Analysis of Sea Ice and Icebergs	FO/OSS	441 (0.0)	350 (3.0)	397 (3.0)	344 (3.0)	420 (3.0)
67112	Prediction of Short Term	FO/OSS	200 (0.0)	130 (0.0)	170 (0.0)	173 (0.0)	10 (0.0)
67113	Small Scale Ice/Ocean Intractions	FO/OSS	179 (2.0)	170 (2.0)	180 (2.0)	191 (2.0)	233 (2.0)
67114	Beaufort Sea Ice Movement	FO/OSS	490 (1.0)	400 (1.0)	310 (1.0)	326 (1.0)	350 (1.0)
67115	Ice Prediction in Real Time Models	EC/AES	284 (0.0)	105 (0.0)	105 (0.0)	145 (0.0)	150 (0.0)
67116	Satellite Radar Info. for Ice Forecasting	EC/AES	95 (0.0)	50 (0.0)	160 (0.0)	834 (0.0)	935 (0.0)
67117	Downlink (Phase II) New Frequency and Data Compression	EC/AES	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
67118	Satellite Communications	EC/AES	53 (0.0)	150 (0.0)	250 (0.0)	105 (0.0)	105 (0.0)
67119	Ice/Water Instrumentation Measurement	FO/OSS	52 (0.0)	100 (0.0)	180 (0.0)	100 (0.0)	50 (0.0)
67120	Ice Thickness Radar	FO/OSS	51 (0.0)	130 (0.0)	115 (0.0)	110 (0.0)	50 (0.0)
67121	Ice Classification Radar	FO/OSS	187 (0.0)	180 (0.0)	150 (0.0)	180 (0.0)	150 (0.0)
67122	Integrated Ice Recce System	EC/AES	247 (0.0)	443 (0.0)	435 (0.0)	213 (0.0)	235 (0.0)
67123	Optimizing Data Transmission	EC/AES	53 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
67124	Ice and Iceberg SAR Experiments	EMR/CCRS	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
67125	Sea Ice Studies	FO/OSS	208 (0.0)	100 (0.0)	80 (0.0)	0 (0.0)	0 (0.0)
67126	Prediction of Oil Spill Movement in Ice Laden Waters	EC/AES	73 (0.0)	90 (0.0)	130 (0.0)	73 (0.0)	83 (0.0)
67127	Laser Profilometer	EC/AES	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
67128	Autonoumous Platform	FO/OSS	46 (0.0)	0 (0.0)	130 (0.0)	120 (0.0)	130 (0.0)
67129	Remote Wind Measurement	FO/OSS	79 (0.0)	70 (0.0)	70 (0.0)	70 (0.0)	83 (0.0)
67130	Remote Ocean Currents	FO/OSS	74 (0.0)	80 (0.0)	80 (0.0)	100 (0.0)	103 (0.0)
67131	Wave Refraction	FO/OSS	131 (0.0)	110 (0.0)	100 (0.0)	60 (0.0)	30 (0.0)
67132	Wave Direction	FO/OSS	0 (0.0)	0 (0.0)	113 (0.0)	170 (0.0)	130 (0.0)
67133	Departmental R&D Management	FO/OSS	28 (0.0)	9 (0.0)	20 (0.0)	30 (0.0)	2 (0.0)
67134	Oceanic Response to Storms	FO/OSS	0 (0.0)	483 (0.0)	110 (0.0)	170 (0.0)	200 (0.0)
67135	Atlantic Storms	EC/AES	0 (0.0)	985 (1.0)	129 (1.0)	100 (1.0)	210 (1.0)
67136	Predicting Ice Breakup	FO/OSS	0 (0.0)	0 (0.0)	40 (0.0)	0 (0.0)	0 (0.0)
67137	Surface Currents/Dixon Entrance	FO/OSS	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
67138	Wind Forecasts Using Expert Systems	EC/AES	0 (0.0)	0 (0.0)	120 (0.0)	0 (0.0)	0 (0.0)
67139	Acoustic/Radar Development	FO/OSS	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	40 (0.0)
67140	Boundary Layer Modelling	EC/AES	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	56 (0.0)
67141	Oceanic Data Retrieval	FO/OSS	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	10 (0.0)
Subprogram 671: Total			4183 (7.5)	6918 (8.5)	6311 (8.5)	6631 (8.5)	6610 (8.5)

TABLE 2-2j-cont'd.
ENERGY R & D RESOURCES
REPORT BY ALL TASKS/PROGRAMS/SUBPROGRAMS
1984/85 RL K$ (P-Y)

TASK: 6 CONVENTIONAL ENERGY SYSTEMS - OIL, GAS, ELECTRICITY

Code	Prog/Subprog/Project	Dept/P.E.	84-85	85-86	86-87	87-88	88-89
672	Environmental Impacts						
67201	Treatment Technologies - Oil & Gas Marine Production Wastes	EC/EPS	73 (0.0)	60 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
67202	Site Restoration - Artificial Islands	EC/EPS	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
67203	Residual Toxicity and Debris - Offshore Well Sites	EC/EPS	125 (0.0)	20 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
67204	Northern Resource Recovery	EC/EPS	36 (0.0)	40 (0.0)	60 (0.0)	80 (1.0)	105 (1.0)
67205	Tech. Assessment/Development - Product Storage	EC/EPS	106 (1.0)	100 (1.0)	100 (1.0)	0 (0.0)	0 (0.0)
67206	Remote Sensing -Chronic Oil Discharges	EC/EPS	88 (0.0)	60 (0.0)	60 (0.0)	30 (0.0)	33 (0.0)
67207	Fish Concentrations Near Dredges	EC/EPS	48 (0.0)	40 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
67208	Oil Poisoning of Seabirds	EC/ECS	135 (0.0)	110 (0.0)	80 (0.0)	80 (0.0)	95 (0.0)
67209	MFO Induction Measurements	FO/OSS	105 (0.0)	100 (0.0)	70 (0.0)	79 (0.0)	105 (0.0)
67210	Under-ice Biota Instrumentation	FO/OSS	130 (0.0)	130 (0.0)	80 (0.0)	0 (0.0)	0 (0.0)
67211	Hydrocarbon Effects Models on Fisheries	FO/OSS	163 (0.0)	60 (0.0)	80 (0.0)	79 (0.0)	0 (0.0)
67212	Hydrocarbon Effects - Biological Submodels	FO/OSS	188 (0.0)	110 (0.0)	100 (0.0)	156 (0.0)	0 (0.0)
67213	Marine Mammal Remote Sensing	FO/ NWTIPM	136 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
67214	Underwater Sound Detection Marine Mammals	FO/ NWTIPM	136 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
67215	Oil Response Test Methods Marine Mammals	FO/ NWTIPM	98 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
67216	Heavy Metals Analysis Method-Marine Mammals	FO/ NWTIPM	28 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
67217	Field Evaluation-Multivariate Biological Monitoring	FO/SFI	100 (0.0)	60 (0.0)	60 (0.0)	0 (0.0)	0 (0.0)
67218	Aerial Survey Techniques - Hooded Seals	FO/SFI	132 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
67219	LNG Spill Control	EC/AES	163 (0.0)	100 (0.0)	10 (0.0)	10 (0.0)	15 (0.0)
67220	Subsurface Oil	EC/EPS	48 (0.0)	60 (0.0)	60 (0.0)	50 (0.0)	50 (0.0)
67221	Laser Fluorosensor	EMR/CCRS	190 (0.0)	192 (0.0)	194 (0.0)	255 (0.0)	210 (0.0)
67222	Monitoring Benthic Perturbations	FO/SFI	32 (0.0)	80 (0.0)	90 (0.0)	50 (0.0)	65 (0.0)
67223	Natural Degradation of Oil	FO/OSS	62 (0.0)	50 (0.0)	40 (0.0)	89 (0.0)	60 (0.0)
67224	Predicting Levels of Elements	FO/OSS	55 (0.0)	25 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
67225	Monitoring Technology	EC/EPS	36 (0.0)	50 (0.0)	70 (0.0)	100 (0.0)	120 (0.0)
67226	Departmental R&D Coordination	EC/AES	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
67227	Hydrocarbon Effects	FO/OSS	0 (0.0)	0 (0.0)	90 (0.0)	120 (0.0)	15 (0.0)
67228	Genetic Adaptability/ Hydrocarbon Stress	FO/OSS	0 (0.0)	0 (0.0)	90 (0.0)	120 (0.0)	150 (0.0)
67229	Odorous Emissions (onshore)	EC/EPS	0 (0.0)	0 (0.0)	40 (0.0)	60 (0.0)	3 (0.0)
67230	Environmental Considerations/ Marine Pipelines	EC/EPS	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
67231	De-emulsification Agents for Spill Control	EC/EPS	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
67232	Protocols/Drilling Fluid Testing	EC/EPS	0 (0.0)	25 (0.0)	60 (0.0)	60 (0.0)	21 (0.0)
67233	Hydrocarbon/Heavy Metal Fate Analysis - Fisheries	FO/SFI	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	25 (0.0)
67234	Hydrocarbon/Heavy Metal Fate Analysis -Environment	EC/EPS	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	30 (0.0)
67235	Effluent Treatment/Dispersant Effectiveness	EC/EPS	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	30 (0.0)
67236	Effects Studies/Salmon/ Seaweed	FO/SFI	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	25 (0.0)
Subprogram 672: Total			2479 (1.0)	1673 (1.0)	1630 (1.0)	1638 (1.0)	1151 (1.0)
PROGRAM 67: TOTAL			6637 (8.5)	6391 (9.5)	5765 (9.5)	5869 (9.5)	5761 (9.5)

TABLE 2-2, cont'd.
ENERGY R & D RESOURCES
REPORT BY ALL TASKS/PROGRAMS/SUBPROGRAMS
1984/85 RL K$ (P-Y)

TASK: 6 CONVENTIONAL ENERGY SYSTEMS - OIL, GAS, ELECTRICITY

Code	Prog/Subprog/Project	Dept/P.E.	84-85	85-86	86-87	87-88	88-89
62	MARINE ENGINEERING						
621	Environmental Design Criteria						
62101	Wave Hindcast Model	FO/OSS	32 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
62102	Ocean Current Hindcast Model	FO/OSS	325 (1.0)	326 (1.0)	327 (1.0)	327 (1.0)	328 (1.0)
62103	Bio Mooring Model for Current Meters	FO/OSS	32 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
62104	Engineering Design Critria	EC/AES	310 (1.5)	50 (0.5)	195 (0.5)	195 (0.5)	195 (0.5)
62105	Program Monitoring	EMR/ COGLA	27 (0.5)	27 (0.5)	27 (0.5)	27 (0.5)	27 (0.5)
62106	Program Monitoring	INA/ COGLA	27 (0.5)	27 (0.5)	27 (0.5)	27 (0.5)	27 (0.5)
62107	Current Surge Design Criteria	FO/OSS	319 (0.0)	179 (0.0)	122 (0.0)	179 (0.0)	100 (0.0)
62108	Wave Forces on Offshore Moored Platforms	FO/OSS	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
62109	Engineerin Design Criteria (Arctic/Pacific)	EC/AES	313 (0.0)	260 (1.0)	370 (1.0)	373 (1.0)	373 (1.0)
62110	Marine Eng. - Adams Island Sea Ice Interaction	NRC/PESI	341 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
62111	Ice Forces on Marine Structures	PWC/DCRT	236 (0.0)	276 (0.0)	112 (0.0)	112 (0.0)	112 (0.0)
62112	Sea Ice Environment Data Base	INA/ COGLA	35 (0.0)	27 (0.0)	0 (0.0)	(0.0)	0 (0.0)
62113	Sea Ice Environment Data Base	EMR/ COGLA	35 (0.0)	27 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
62114	Deep Water Wave Breaking	EC/ECS	0 (0.0)	100 (0.0)	60 (0.0)	25 (0.0)	0 (0.0)
Subprogram 621: Total			1972 (3.5)	1299 (3.5)	1240 (3.5)	1267 (3.5)	1164 (3.5)
622	Safety Technology						
62201	Evaluation of Emergency Equipment & Sea-Rescue Techniques	EMR/ COGLA	167 (0.0)	176 (0.0)	176 (0.0)	178 (0.0)	178 (0.0)
62202	Evaluation of Emergency Equipment & Sea-Rescue Techniques	EMR/ COGLA	167 (0.0)	176 (0.0)	176 (0.0)	178 (0.0)	178 (0.0)
62203	Emergency Ascent Control	EMR/ COGLA	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
62204	Emergency Ascent Control	INA/ COGLA	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
62205	Undersea Robotics Systems	EMR/ COGLA	84 (0.0)	66 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
62206	Undersea Robotics Systems	INA/ COGLA	84 (0.0)	56 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Subprogram 622: Total			502 (0.0)	484 (0.0)	352 (0.0)	356 (0.0)	356 (0.0)
623	Marine Structures Engineering						
62301	Concrete Marine Caissons	PWC/ DCRT	336 (0.0)	224 (0.0)	224 (0.0)	112 (0.0)	112 (0.0)
62302	Arctic Shore Protection System	PWC/ DCRT	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
62303	Marine Eng. - Deepwater Offshore Engineering	NRC/ PESI	805 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
62304	Deepwater Offshore Engineering	FO/OSS	337 (2.0)	200 (2.0)	198 (2.0)	198 (2.0)	198 (2.0)
62305	Evaluation of General Design Criteria	EMR/ COGLA	140 (0.0)	42 (0.0)	108 (0.0)	137 (0.0)	140 (0.0)
62306	Evaluation of General Design Criteria	INA/ COGLA	140 (0.0)	42 (0.0)	100 (0.0)	137 (0.0)	140 (0.0)
62307	Design Guidelines - Artificial Islands	EC/ECS	33 (0.0)	50 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
62308	In Situ Inspection and Monitoring Technology	EMR/ COGLA	0 (0.0)	0 (0.0)	121 (0.0)	244 (0.0)	331 (0.0)
62309	In Situ Inspection and Monitoring Technology	INA/ COGLA	0 (0.0)	0 (0.0)	121 (0.0)	244 (0.0)	331 (0.0)
Subprogram 623: Total			1811 (2.0)	558 (2.0)	880 (2.0)	1072 (2.0)	1232 (2.0)
PROGRAM 62: TOTAL			4285 (5.5)	2341 (5.5)	2472 (5.5)	2695 (5.5)	2772 (5.5)

TABLE 2-3

DISTRIBUTION OF PERD 6.7 FUNDS BY SUBJECT AREA ($K)
All Departments

SUBJECT	84/85	85/86	86/87	87/88	88/89
Weather	216	1190	459	395	508
Waves and Currents	1242	1278	1040	1135	1170
Sea Ice and Icebergs	2540	2310	2592	2723	2690
Ecological Studies	797	210	360	475	165
Monitoring	1251	903	804	763	781
Waste Treatment	215	200	200	140	140
Oilspill Studies	284	250	200	133	150
Data Analysis	112	50	90	105	117
TOTAL	6657	6391	5745	5869	5721

Figure 2-7. 1984/85 PERD 6.7 Funds by Subject Area ($K)/All Departments

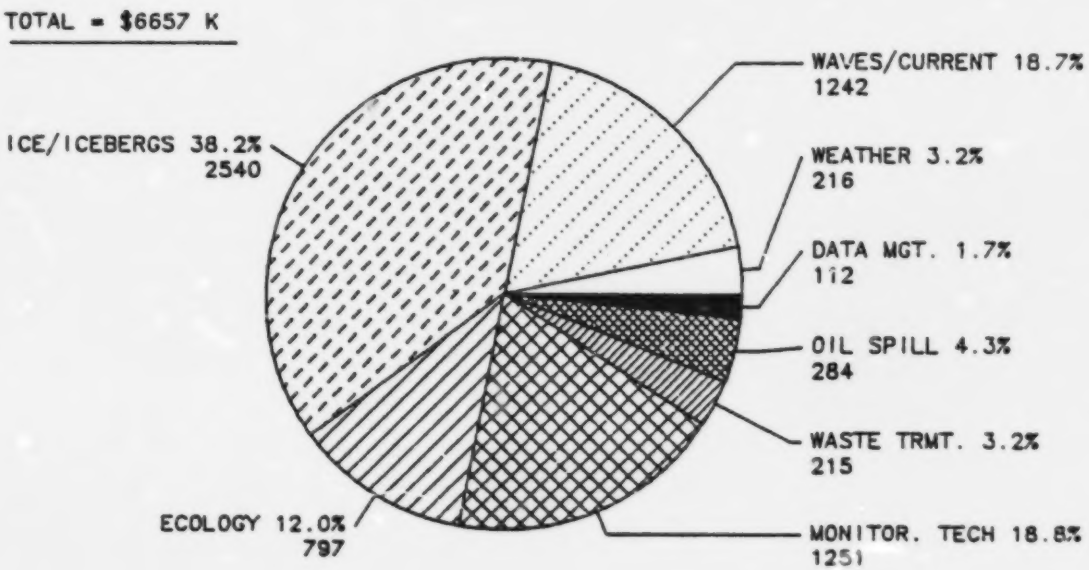


TABLE 2-4

ENVIRONMENT COMMITTEE

DFO PROJECTS BY SUBJECT AREA

Subject Area	82/83	83/84	84/85	85/86	86/87	87/88	88/89	89/90
Waves	0	34	131	110	215	230	180	0
Currents	344	487	516	813	440	500	560	420
Sea Ice/Icebergs	557	1187	1808	1560	1622	1424	1265	1005
Acoustics	0	30	153	150	150	170	230	669
Data Analysis	0	590	112	50	90	105	117	503
Biological Monitoring	0	462	657	446	340	218	280	995
Ecological Research	0	312	351	170	360	475	165	95
Marine Mammals	0	478	398	0	0	0	0	0
Totals	**901**	**3580**	**4126**	**3299**	**3217**	**3122**	**2797**	**3687**

ENVIRONMENT COMMITTEE

DFO PROJECTS BY OCEAN AREA

Ocean Area	82/83	83/84	84/85	85/86	86/87	87/88	88/89	89/90
Atlantic	192	1215	926	1133	1060	1193	980	1060
Arctic	709	2321	3041	2056	1922	1669	1560	1110
Pacific	0	34	131	110	100	60	50	0
Non-specific	0	10	28	0	135	200	207	1517
Totals	**901**	**3580**	**4126**	**3299**	**3217**	**3122**	**2797**	**3687**

TABLE 2-5

DISTRIBUTION OF ENVIRONMENT CANADA PROJECTS FOR PERD 6.7 BY SUBJECT AREA ($K)

SUBJECT	84/85	85/86	86/87	87/88	88/89
Weather	137	1120	389	325	423
Waves	321	275	305	305	325
Sea Ice and Icebergs	732	750	970	1299	1425
Ecological Studies	48	40	0	0	0
Monitoring Techniques	404	265	270	290	291
Waste Treatment	215	200	200	140	140
Oilspill Studies	281	230	200	133	150
TOTAL	2341	2901	2334	2492	2754

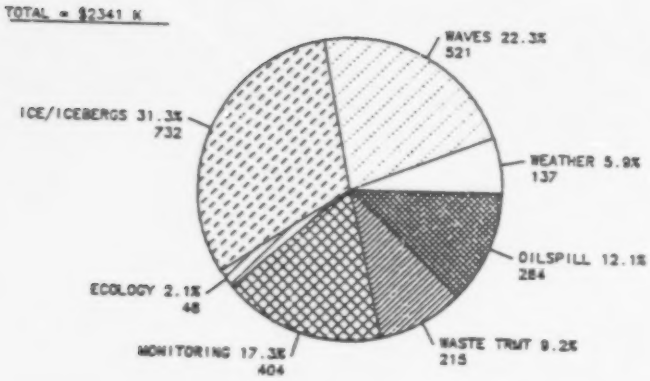


Figure 2-8. 1984/85 PERD 6.7 Funds by Subject Area ($K)
Environment Canada

TABLE 2-6

DISTRIBUTION OF CCRS (EMR) PROJECTS FOR PERD 6.7 ($K)

SUBJECT	84/85	85/86	86/87	87/88	88/89
Monitoring Techniques	190	192	194	255	210

TABLE 2-7

ESRF PROGRAM STUDY COMMITTEES

COMMITTEE	CHAIRMAN
Effects Monitoring	Mr. Mac Mercer Fisheries Research Branch, St. John's
Icebergs	Dr. Ken Sato, COGLA Ottawa
Oil Spill Research and Countermeasures	Howard Hume, Petro-Canada, Calgary
Waves	Mike Coolen, Mobil Oil, Halifax

Six other Program Study Committees (Social Issuses North, East and West; Bottom Sediment Transport; Sea Bottom Ice Scour; and Northern Terrestrial and Freshwater) do not relate to PERD Task 6.7 activities.

Links

As stated previously, there is considerable overlap between ESRF Program Study Committee members and members of PERD Task 6 Committees. An example of the technical exchange between these groups, which occurs both informally and formally, is a recent workshop on ice scour research, which was co-sponsored by ESRF and PERD.

Funding Level

Each of the two revolving funds has a ceiling of $15 million. However, the current fund levels are well below this ceiling. Annual fund levels and available funding for each program area are not set prior to identification of studies. Rather, the annual funding level arises out of the study needs identified by the Program Study Committees and approved by the Advisory Board and the two Ministers.

Tables 2-8 and 2-9 show the distribution of ESRF expenditures by subject area and by region, respectively. ESRF studies, relevant to PERD 6.7, carried out during 1983 and 1984 are listed in Table 2-10.

The breakdown of ESRF 1984 expenditures by region and by subject area are shown in Figures 2-10 and 2-11, respectively.

2.2 ENVIRONMENTAL STUDIES REVOLVING FUNDS (ESRF)

The two Environmental Studies Revolving Funds are administered by Energy, Mines and Resources (COGLA) and Indian and Northern Affairs Canada. The funds are financed entirely by levies on oil and gas companies holding interests on Canada Lands.

Environmental or social studies funded through the ESRF must be:

(1) regional or national in scope;
(2) supplementary or complementary to government activities; and
(3) address decision-making issues clearly related to oil and gas exploration and development activities.

The ESRF do not fund studies involving environmental review, compliance or design related to a specific project or site-specific area; nor do they fund traditional areas of government study for on-going resource management, environmental review of industrial proposals, maintenance of in-house expertise and support of government programs. (ESRF 1983)

Objectives

R and D studies funded by the ESRF are intended to yield the necessary information for government and industry decision-making on oil and gas exploration and development activities on Canada Lands. The results are to be used to ensure the design of safe, cost-effective exploration and development systems.

Structure

The two ESRF have a joint Advisory Board, chaired by the Director General, Environmental Protection Branch for COGLA (when the Board addresses issues south of 60° N latitude), and chaired by the Director General, Northern Environment, INAC (when the Board addresses issues north of 60° North). The Advisory Board reports jointly to the Minister, Energy, Mines and Resources; and to the Minister, Indian and Northern Affairs Canada. Figure 2-9 shows the structure of the Advisory Board. The Advisory Board is supported by two Fund Managers and staff. Dr. J McTaggart-Cowan is the ESRF (EMR) manager, and Dr. O. Løken is the ESRF (INAC) manager.

The ESRF have ten Program Study Committees which identify important areas for study and make recommendations to the Advisory Board on projects to be funded each year. Table 2-7 lists those Committees which address research areas related to PERD 6.7, and the Chairman for each. Members of the committees are knowledgeable industry and government scientists and research managers.

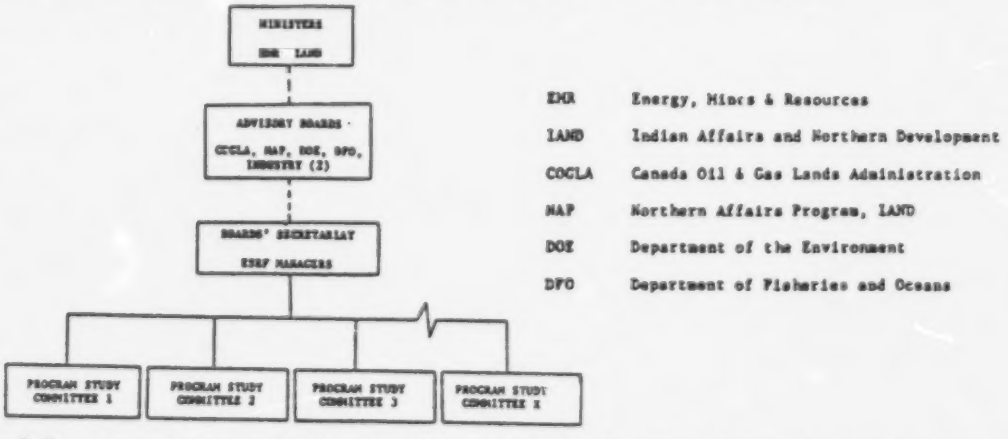

EMR Energy, Mines & Resources
INAND Indian Affairs and Northern Development
COGLA Canada Oil & Gas Lands Administration
NAP Northern Affairs Program, INAND
DOE Department of the Environment
DFO Department of Fisheries and Oceans

Figure 2-9. Organization of the Environmental Studies Revolving Funds, 1983.

TABLE 2-8

DISTRIBUTION OF ESRF EXPENDITURES BY SUBJECT AREA ($K)
Subject Areas Relevant to PERD 6.7

SUBJECT AREA	1983	1984	1985
Waves	250	392	280
Icebergs	792	699	400
Effects Monitoring	200	570	675
Oilspill[1]	1249	1109	525
TOTAL	**2491**	**2770**	**1880**

1 includes some R + D directed at terrestrial oilspills

TABLE 2-9

DISTRIBUTION OF ESRF EXPENDITURES BY REGION
Subjects Relevant to PERD 6.7 ($K)

REGION	1983	1984	1985
East Coast[1]	1383	1591	1164
West Coast	79	123	23
Beaufort/Arctic	1029	1056	693
TOTAL	2491	2770	1880

1 includes Hudson Bay

TABLE 2-10

ESRF PROJECTS (1983 - 1984) RELEVANT TO PERD 6.7

EFFECTS MONITORING			
1983	1983 Beaufort Bowhead Whale Monitoring Study	Dome Petroleum Limited Calgary, Alberta.	100,000
	Effects Monitoring State-of-the-Art Review	LGL Limited St. John's, Nfld.	100,000
1984	1984 Beaufort Bowhead Whale Monitoring Study	ESL Environmental Sciences Limited Vancouver, B.C.	84,000
	1984 Beaufort Seal Monitoring Study	Dept. of Fisheries and Oceans Winnipeg, Manitoba	28,000
	Beaufort Sea Shorebase Monitoring Program, 1984	Dept. of Indian & Northern Affairs Yellowknife, NWT	25,000
	* Tainting of Fishery Resources	Martec Limited Halifax, N.S.	29,000
	The Factors Determining Bowhead Whale Distribution: Feasibility Study	LGL Limited King City, Ontario	40,000
	* Oil Based Drilling Muds Off Structure Monitoring	Dobrocky Seatech Ltd. Sidney, B.C.	364,000
WAVES			
1983	Directional Wave Spectrum Inter-comparison Study - Task 1, 2 and 4	Seakem Oceanography Ltd. Sidney, B.C.	87,000
	Directional Wave Spectra Intercomparison Task 3	F.G. Bercha & Assoc. St. John's, Nfld.	18,000

* NOTE: Notification letters sent, but Study Agreements not yet signed.

	Directional Wave Spectra Intercomparison Field Installation - Phase 0	Petro-Canada Calgary, Alberta	96,000
	Identification of Significant Storms Affecting East Coast Offshore Areas	MEP Company Ltd. Markham, Ontario	46,000
1984	Directional Wave Study Northern Coast of B.C.	Dobrocky Seatech Limited	153,000
	Beaufort Sea Extreme Wave Studies Assessment	Det Norske Veritas (Canada) Ltd. in Association with Canmar Ltd.	47,200
	Hindcast Sensitivity	Newfoundland Marine Sciences	51,500
*	Wave Forecasting in the Canadian Operational Context	Seaconsult Marine Research Limited Dartmouth, N.S.	64,800
*	Investigation of Shallow Water Models	Seaconsult Marine Research Limited Dartmouth, N.S.	170,000
	Others		
1984	(ASTIS) - Arctic Sciences Technological Information Systems	Arctic Institute of North America Calgary, Alberta	375,000

ICEBERGS

1983	Assessment of Airborne Imaging Radars for the Detection of Icebergs		
	- Phase I	CANPOLAR Ltd. Toronto, Ont.	1,000
	- Phase II	F.G. Bercha & Assoc. St. John's, Nfld.	194,000
	- Phase III	CANPOLAR Ltd. Toronto, Ont.	78,000
	- Phase IV	Interra Ltd. Calgary, Alberta	190,000

	Assessment of Marine Radars for the Detection of Ice and Icebergs	Viatec Resources Inc. Calgary, Alberta	205,000
	Underwater Iceberg Geometry	Nordco Ltd. St. John's, Nfld.	100,000
1984	* Management of Small Ice Masses	Dobrocky Seatech Limited	69,000
	* Motion and Impact of Icebergs	Hay and Company	75,000
	Fracturing of Icebergs	Ice Engineering Ltd.	79,000
	* Enhancement of the Radar Detectability of Icebergs	Viatec Resources	47,000
	* Long Range Prediction of Iceberg Season Severity	Arctic Sciences Ltd.	72,000
	* Long Range Prediction of Iceberg Season Severity	Seaconsult Ltd.	80,000

OIL SPILL RESEARCH & COUNTERMEASURES

1983	Hydrocarbon Chemistry Component - BIOS Project	Environment Canada Edmonton, Alberta	117,000
	Macrobenthos Component - BIOS project	Petro-Canada Calgary, Alberta	302,000
	Microbiology Component - BIOS Project	Environment Canada Edmonton, Alberta	114,000
	Shoreline Component - BIOS Project	Petro-Canada Calgary, Alberta	30,000
	Oil in Ice Computer Model - COOSRA	Dome Petroleum Limited Calgary, Alberta	47,000
	Oil in Pack Ice - COOSRA	Esso Resources Canada Limited Calgary, Alberta	43,000
	Simple Remote Sensing System - COOSRA	Esso Resources Canada Limited Calgary, Alberta	80,000

1984	Decision-Making - Dispersants Areas of Application for the Beaufort Sea	Canadian Marine Drilling Limited Calgary, Alberta	84,000
	Decision-Making - Guide for Shoreline Protection and Cleanup	Dobrocky Seatech Limited Sidney, B.C.	40,000
1984	Field Research Spills to Investigate the Physical & Chemical Fate of Oil in Pack Ice	S.L. Ross Environmental Research Limited Ottawa, Ontario	192,000
	Calibration Data for Oil Under Ice Model	Arctec Canada Ltd. Kanata, Ontario	38,000
	* Spills of Opportunity Plan	Hatfield Consultants Vancouver, B.C.	45,000
	* 1985 Beaufort Sea Dispersant Trial	Canmar Calgary, Alberta	250,000
	* Development of a Shoreline Monitoring Program for Spills of Opportunity	Dobrocky Seatech Limited Sidney, B.C.	141,000
1984	Decision-Making Procedures for Igniting Oil Well Blowouts	S.L. Ross Environmental Research Limited Ottawa, Ontario	61,000
	Detection of Oil Under Ice - Experimental Evaluation of an EM Sensor for Detection of Oil Under Ice	Arctec Canada Ltd. Ottawa, Ontario	29,000
	Oil Spill Counter-measures Training	S.L. Ross Environmental Research Limited Ottawa, Ontario	151,000
	Recovery of Oil from Broken Ice - Development and Testing of an Oil Recovery Concept for use in Brash & Mulched Ice	S.L. Ross Environmental Research Limited Ottawa, Ontario	93,000

Recovery of Oil from Broken Ice - Proposal for Testing an Oil Skimming Bow in Broken Ice Field	Arctec Canada Ltd. Ottawa, Ontario	63,000
* Experiments for Evaluating the Fate of Oil in Low Energy Marine Environments	Dobrocky Seatech Limited/Seakem Oceanography Ltd.	93,000
* Meso-scale Experiments to Determine the Effectiveness of Oil Spill Dispersants	S.L. Ross Environmental Research Limited Ottawa, Ontario	50,000
* The Continued Development of a Mixing System to be Used with Vessel-Based Dispersants and The Evaluation of the Effectiveness of the Repeat Application of Dispersants	S.L. Ross Environmental Research Limited Ottawa, Ontario	54,000

Figure 2-10. 1984 ESRF Expenditures by Region ($K)
Subject Area Relevant to PERD 6.7

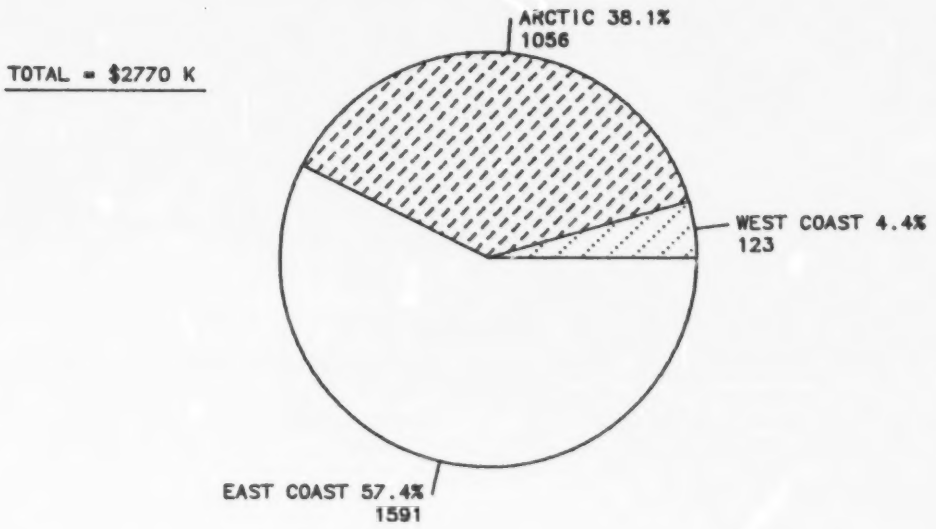
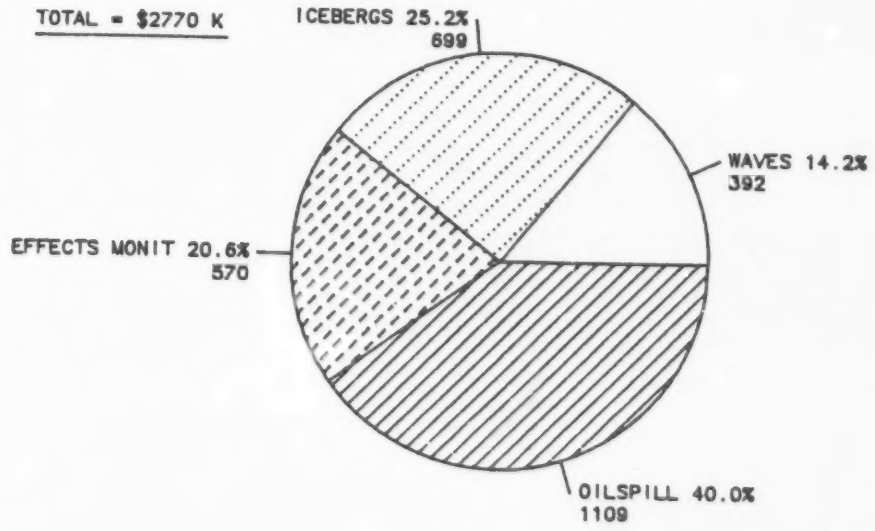


Figure 2-11. 1984 ESRF Expenditures by Subject ARea ($K)
Subject Areas Relevant to PERD 6.7.



2.3 NORTHERN OIL AND GAS ACTION PLAN (NOGAP)

Objective

NOGAP is intended to advance the state of government preparedness for hydrocarbon development in the North. To achieve this, the program will accelerate the policy, planning and regulatory research activities of the member departments/territorial governments in a coordinated fashion.

As such, NOGAP projects are primarily an augmentation of existing federal departments activities. In the case of territorial governments, NOGAP projects tend to be new activities. NOGAP should be viewed as a source of funds for new projects only after all alternatives have been exhausted. (NOGAP 1984).

Structure

NOGAP funds are administered at the departmental level by NOGAP coordinators. The departmental coordinators, along with Ruth Rodger who is the Senior Planning Coordinator for all NOGAP (Table 2-11), meet together as the Committee of NOGAP Coordinators to set priorities for NOGAP funding and to review project proposals from the member departments. This Committee makes its recommendations on funding to the Senior Policy Committee, Northern Resource Development Projects (SPCNRDP). This senior Committee is an interdepartmental and intergovernmental body, at the ADM level, which provides policy direction to NOGAP (among other responsibilities).

Links

NOGAP links to PERD Task 6 have been previously described in Section 2.1. The SPCNRDP provides a senior level link between NOGAP and the participating deparments. At the program management level, the NOGAP Committee of Coordinators provides such a link. The Beaufort Environmental Monitoring Project, funded by NOGAP, facilitates the setting of research priorities and the exchange of research results among interested industry and government scientists and research managers.

Program Funding

NOGAP funds are assigned on a project basis. Each project title is broad and may have several specific sub-projects (studies) under it. Funds from NOGAP are available to several federal government departments (see Table 2-11). Projects funded in 1984/1985, which are relevant to PERD 6.7, are shown in Table 2-12. Proposed projects and expenditures submitted by various departments for 1985/1986 and future years are shown on Table 2-13 and 2-14. These proposals had not been approved at the time of this report. NOGAP expenditures by subject area for 1984/85 are shown in Figure 2-12.

TABLE 2-11

NOGAP COORDINATORS

1. Ruth Rodger
   Senior Planning Coordinator
   NOGAP Secretariat
   Indian and Northern Affairs Canada
   Les Terrasses de la Chaudiere
   Ottawa, Ontario
   K1A 0H4
   (819) 997-0880

2a. Bryan Cook
   Office of Energy Research and Development
   Energy, Mines and Resources Canada
   580 Booth Street
   Ottawa, Ontario
   K1A 0E4
   (613) 995-9351 (ext. 214)

   Note: B. Cook is contact for NOGAP/PERD interface

2b. Dr. John Fyles
   Chief Geologist
   Geological Survey of Canada
   Energy, Mines and Resources Canada
   601 Booth Street
   Ottawa, Ontario
   K1A 0E8
   (613) 995-4249

   Note: J. Fyles is contact for NOGAP projects

3. Bill Brakel
   Economic and Environmental Affairs Advisor
   Environment Canada
   804, 9942 - 108th Street
   Edmonton, Alberta
   T5K 2J5
   (403) 420-2554

4. Ken Yuen
   Chief, Ocean Science Affairs
   Fisheries and Oceans
   200 Kent Street
   Ottawa, Ontario
   K1A 0E6
   (613) 990-0311

5. Rick Hurst
   Environmental Studies Coordinator
   Renewable Resources and Northern Environment Branch
   Indian and Northern Affairs Canada
   Les Terrasses de la Chaudiere
   K1A 0H4
   (819) 997-0044

6. Jacques Cinq-Mars
   Chairman, Rescue Archaeology Program
   Archaeological Survey of Canada
   National Museum of Man
   Ottawa, Ontario
   K1A 0M8
   (819) 997-8173

7. Ian Marr
   Special Projects and Policy Coordination (DCGP/M)
   Canadian Coast Guard
   Transport Canada
   Ottawa, Ontario
   K1A 0N7
   (613) 593-6985

8. Margaret McGee
   Energy, Mines and Resources Secretariat
   Government of the Northwest Territories
   Yellowknife, N.W.T.
   X1A 2L9
   (403) 873-7588

9. Bruce Demchuk
   Major Projects Branch
   Department of Economic Development and Tourism
   Government of Yukon
   Box 2703
   Whitehorse, Yukon
   Y1A 2C6
   (403) 667-5737

TABLE 2-12

NOGAP PROJECTS 1984/1985 RELEVANT TO PERD 6.7

	$K	p-y
WEATHER		
Project: Beaufort Sea Forecasting Techniques (AES Downsview) (NOGAP C16)		
Subprojects:		
(1) Development of a Freezing Spray Forecast System	25	0.6
(2) Evaluation of MOS Wind Forecasts at 17 Northern Locations	0.4	
(3) Test of Wind and Visibility Perfect Program Forecast Techniques in Beaufort Sea	40	-
(4) Adaptation of Storm Surge Forecast Model for the Southern Beaufort Sea	*	-
* NOGAP funds reallocated; work begun with PERD funds		
Project: Collection and Analysis of Weather, Sea State and Climate Information for the Beaufort Sea (AES Edmonton) (NOGAP C17)	50	-
Project: Tanker Climatologies (AES Downsview) (NOGAP C18)	1.5	
Subprojects:		
(1) Evaluation/Updating of Existing Climatologies	29	-
(2) Wind Intercomparisons	22	-
(3) Climate Analysis Software Systems	8	-
(4) Offshore Energy Bibliography	8	-
WAVES		
Project: Beaufort Sea Wave Climate Data Collection (DFO/OSS Ottawa) (NOGAP B8)	160	1

	$K	p-y
OCEANOGRAPHY (Non-Specific)		
Project: Integrated Studies of Oceanographic Process Involved in Interaction Between Arctic Ocean and Beaufort Shelf (DFO/IOS, Sidney) (NOGAP B6a)	46*	-
*several other sources of funds including A-Base (17 p-y), PERD and Transport R&D		
Project: Physical Oceanography of the Eastern Arctic (AOL/BIO, Dartmouth) (NOGAP B10)	65	1
ICE		
Project: Physical Environment: Processes and Impacts (INAC, Ottawa) (NOGAP A6)		
Subprojects:		
(1) Sverdrup Basin Ice Navigation	40	0.1
ENVIRONMENTAL EFFECTS		
Project: Offshore Environmental Monitoring (INAC, Ottawa) (NOGAP A7)	0.5	
Subprojects:		
(1) Beaufort Environmental Monitoring Project Management (BEMP)*	140	-
*(see section 3.5 for BEMP details)		
(2) Beaufort Bowhead Monitoring Study	48	-
Project: Non-Summer Ecology of Arctic Marine Ecosystems (MEL/BIO, Dartmouth) (NOGAP B9)	300	3

	$K	p-y
MONITORING METHODS/MANAGEMENT		
Project: Studies to Support Development of Technical Guidelines for Marine Management (INAC, Yellowknife) (NOGAP A20)		1
Subprojects:		
(1) Estimation of Oxygen Demand by Oil-Based Mud Cuttings in Arctic Marine Waters	50	-
(2) Arctic Marine Methods Manual Phase II	10	
Project: Marine Monitoring Advisory Capability: Development of Guidelines for Monitoring (EC/EPS, Yellowknife) (NOGAP C3)	-	
WASTE TREATMENT/DISPOSAL/CONTROL TECHNOLOGIES		
Project: Ocean Dump Site Investigation for Wastes from Hydrocarbon Exploration and Production (EC/EPS, Yellowknife) (NOGAP C4)	19	-
OIL SPILL STUDIES		
Project: Regional Terrestrial Environment (INAC Ottawa) (NOGAP A6)		
Subproject: Coastal Oil Spill Sensitivity Mapping in Byam Channel	20	0.1
DATA MANAGEMENT		
Project: Oceanographic Data Management (DFO/OSS, Ottawa) (NOGAP B7)	50	1

TABLE 2-13

NOGAP PROPOSED PROJECTS RELEVANT TO PERD 6.7
1985/86 TO 1988/89

WEATHER

Beaufort Sea Forecasting Techniques*

Beaufort Data Base (Collection and Analysis of Weather, Sea State and Climate Information)*

Tanker Climatologies*

WAVES

Beaufort Sea Wave Climate Data Collection

OCEANOGRAPHY - NON-SPECIFIC

Beaufort Oceanography (Integrated Studies in Physical, Chemical and Biological Oceanography)

ICE

Ice Breakup in the Lower Mackenzie Delta

HYDROGRAPHY

Hydrography - Northwest Passage

ENVIRONMENTAL EFFECTS

Offshore Environmental Monitoring (includes BEMP)

Disturbance of Marine Mammals

Oil - Marine Wildlife

Contaminants - Marine Food Species

Vessel/Marine Mammal Interactions

Effects of Oil Development on Marine Birds in High Arctic*

Impact Assessment on Marine Birds in High Arctic*

MONITORING METHODS/MANAGEMENT

Hydrocarbon Research/Management (Studies in Support of Development of Technical Guidelines)

Marine Monitoring Advisory Capability*

ECOLOGY

Marine Habitat

Non-Summer Ecology of Arctic Marine Ecosystems

Shorebird Surveys in Mackenzie Delta*

Geese Distribution Studies in Beaufort Region*

Feeding Ecology of Moulting Marine Waterfowl*

Moulting and Staging Concentrations of Sea Birds in Beaufort Region*

OILSPILL

Oil Spill Atlas*

WASTE TREATMENT/CONTROL TECHNOLOGIES

Environmental Considerations of Northern Marine Pipelines and Control Technologies

DATA MANAGEMENT

Ocean Data Management

* Preliminary proposals

TABLE 2-14

NOGAP PROPOSED EXPENDITURES FOR 84/85 TO 88/89 BY SUBJECT AREA RELEVANT TO PERD 6.7 $K (p-y)*

	84/85		85/86	86/87	87/88	88/89
Weather	203	(2.1)	403	303	275	225
Waves	160	(1)	75	62	136	39
Beaufort Oceanography physical, chemical, biological)	111	(1)	95	820	1370	1470
Ice	40	(0.1)	50	62	57	-
Hydrography	-		809	-	-	416
Environmental Effects	488	(3.5)	1124	1581	1119	1007
Monitoring Methods/ Management	81	(1)	384	330	220	425
Ecology	-		1185	1096	1038	270
Oil Spill Studies	20	(0.1)	75	75	75	75
Control Technologies	19		80	160	80	-
Data Management	50	(1)	110	80	60	30
TOTAL($K)	1172		4390	4569	4430	3977
TOTAL (p-y)		(9.8)				

* Proposed expenditures have not yet been approved for 85/86 and on.

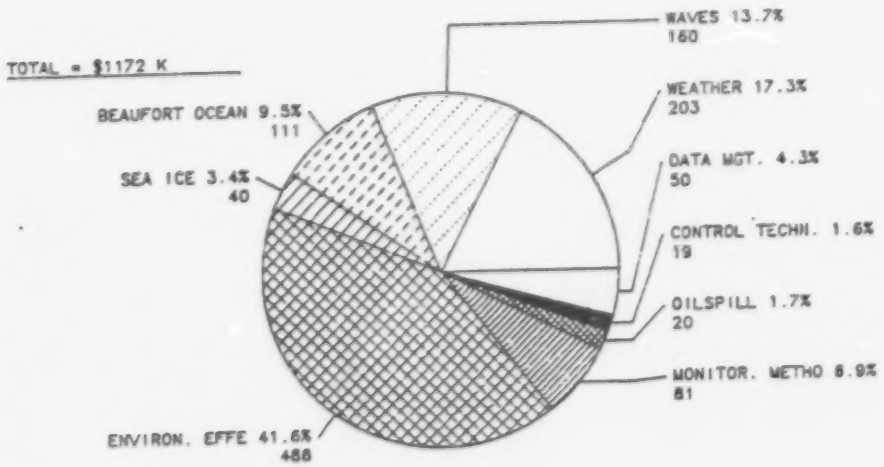


Figure 2-12. NOGAP Expenditures by Subject Area ($K) Subjects Relevant to PERD 6.7

3. FEDERAL DEPARTMENTS A-BASE RESEARCH AND DEVELOPMENT

3.1 Canada Oil and Gas Lands Administration

COGLA funds little environmental research directly. However, it has need for results from R and D programs to provide the technical basis for its regulatory responsibilities on Canada Lands. As such, it relies on R and D conducted by PERD, ESRF and other departments. COGLA participates actively on the PERD Task 6 committees, and on the ESRF program study committees. This participation allows COGLA to have its priorities considered by the research funds.

Occasionaly, COGLA will commission a study to address short-term regulatory needs. A recent example was a study of factors affecting relief-well capabilities on Canada Lands. The study included an assessment of physical environment conditions affecting relief-well capability.

Priorities

COGLA established R and D priorities in 1984, by region and by subject area. Research related to oil and gas activities from the Hibernia (Grand Banks) and Venture (Scotian Shelf) areas is its highest priority for offshore areas. Nearshore Beaufort Sea and Arctic Islands (particularly related to the Bent Horn project) research is also high priority.

Research related to offshore Beaufort Sea (beyond the 20-metre contour), the Labrador Shelf, and the Atlantic Slope is lower priority, because of the expected longer time for oil and gas development to begin.

Table 3-1 lists COGLA R and D priorities by subject area. Only those subject areas relevant to PERD 6.7 are listed. Other priorities fall under the categories of Engineering, Human Safety and Resource Evaluation.

TABLE 3-1

COGLA R AND D PRIORITIES (1984) RELEVANT TO PERD 6.7

Physical Environment

Climatological Atlases - develop data bases, archiving capability, and retrieval capabilities for oceanographic data in all regions.

Circulation Modelling - develop, run, and calibrate two or three-dimensional circulation models for all regions. Develop long-term data monitoring strategies for model verification and process elucidation.

Planetary Boundary Layer Modelling - upgrade existing models to improve weather prediction.

Instrument Development - develop acoustic and radar systems for currents, waves, and ice detection at meso-length scales (30 - 50 km).

Process Oriented Research - vertical current profiles, shear zone processes in the Beaufort Sea; upper water layer processes relating to mixing and drift of oil spills; processes affecting interannual variability of currents, waves, and ice.

Engineering/Structural - sensitivity of platform design to oceanographic and meteorological parameters.

Biological Environment

Fate Studies (Hydrocarbons and Heavy Metals) - assess the bioavailability of heavy metals released from barites, assess the biodegradation rates of oil retained on cuttings from oil-based drilling mud.

Effluent Treatment - establish a data base of chemical products used in offshore petroleum activities, evaluate the performance of waste treatment systems relative to severe climatic conditions, assess the effectiveness of oil-water treatment systems.

Dispersants - evaluate the effectiveness of oil dispersants in high silt content waters.

Sound and Shock-Wave Energy - evaluate the energy and acoustic character of noise originating from petroleum related activities including chemical explosions used in seismic and other marine operations.

Effects Studies

- A - determine interference with homing of salmon by hydrocarbons.
- B - evaluation of the effects of oil exposure on seaweeds communities, used as a harvested resource or critical as commercial fish spawning habitats.

3.2 Environment Canada

3.2.1 Atmospheric Environment Service

The distribution of AES A-base funds by subject area is shown in Table 3-2 and Figure 3-1. AES A-base and other funding support for PERD projects are summarised in Table 3-3.

TABLE 3-2

DISTRIBUTION OF AES A-BASE AND OTHER RESEARCH FUNDS (OTHER THAN PERD) BY SUBJECT AREA ($K)

	83/84	84/85
Weather/Climate	200	835
Waves	0	2
Ice	260	260
Oilspill	7	7
TOTAL	**467**	**1104**

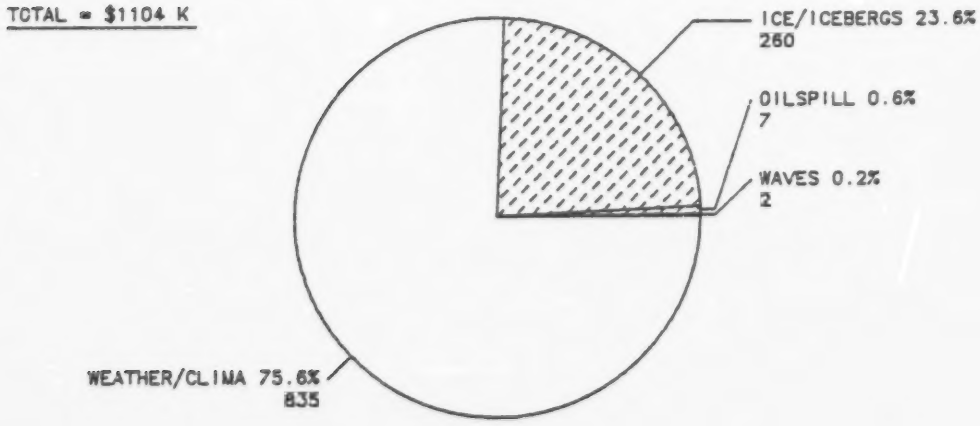


Figure 3.1. 1984/85 AES Expenditures by Subject ($K)
Subjects Relevant to PERD 6.7.

TABLE 3-3

AES A-BASE AND OTHER FUNDING SUPPORT FOR PERD PROJECTS
A-Base Unless Otherwise Stated

	Funding $K (p-y)				
	83/84	84/85	85/86	86/87	87/88
Program: Real-Time Forecasting Systems					
Priority Region: East Coast Offshore					
Wind Forecasts Using Expert Systems (PERD 67138)	-	-	-	120(0)	-
Program: Canadian Mesoscale Program (PERD 67135)					
Canadian Atlantic Storms Program (CASP)	-	650(9)	350(5)	250(4)	-
Program: East Coast Eng. Design Criteria (PERD 62104)	60(0.5)	65(0.5)	50(0.5)	70(0.5)	70(0.5)
Program: Arctic/Pacific Eng. Design Criteria (PERD 62109)	130(1)	100(1)	125(1)	125(1)	125(1)
Program: Passive Microwave Mapping of Meteorological and Marine Parameters (proposed to PERD)					
Wind Speed over Ice-Free Water	10	20	-	-	-
Regional Wave Heights	-	2	-	-	-
Regional Ice Information	200*	200*	-	-	-
Program: Assessment of Techniques for Modelling LNG/LPG Spills (PERD 67219)	6.5	6.5	120	-	-
Program: Ice Reconnaissance	60**	60**	-	-	-
TOTAL $K	**467**	**1104**	**731**	**565**	**195**
TOTAL (p-y)	**(1.5)**	**(10.5)**	**(6.5)**	**(5.5)**	**(1.5)**

* Source of funds: Arctic Marine R and D
** Relevant A-Base R and D; not in support of PERD

3.2.2 Canadian Wildlife Service

A summary of CWS A-base and other research funds (non-PERD) relevant to PERD 6-7 is shown in Table 3-4.

TABLE 3-4

CANADIAN WILDLIFE SERVICE
A-BASE AND OTHER RESEARCH FUNDS (NON-PERD) RELEVANT TO PERD 6.7

Source of Support	1983-84		1984-85		1985-86		1986-87		Notes
Direct Support of oil Toxicological Studies									
CWS, "A"-Base	(1P-Y)	20K	(1P-Y)	20K	(1P-Y)	20K	(1P-Y)	20K	
American Petroleum Institute		25K		25K		25K		-	Supporting part of field studies.
Complementary Oil Toxicological Studies									
N.S.E.R.C.		56K		69K		69K		68K	Studies on other aspects of oil toxicology at Memorial University, Dept. of Biochemistry, CWS personnel work in the same labs of some joint experiments during the summer.
Baseline studies on seabirds									
CWS, "A"-Base	(3P-Y)	80K	(4P-Y)	80K	(4P-Y)	80K	(4P-Y)	80K	This work does not involve direct toxicolotical studies but includes the beached bird survey work which is directly related. Provides important baseline data on seabirds. some sharing of field facilities.
	(4P-Y)	176K	(5P-Y)	194K	(5P-Y)	194K	(5P-Y)	168K	

3.2.3 Environmental Protection Service

Arctic Marine Oilspill Program (AMOP)

This fund was established in 1977 through a special allocation to the A-Base funding of the Environmental Protection Service. Funding levels were $1.7 million and 3 p-y per year for five years. This level has now been reduced to $0.835 million and 2 p-y per year.

The objective of AMOP is to develop oil spill countermeasures for use in offshore Arctic waters (recently extended to include land spills as well). The knowledge gained assists operational agencies such as Canadian Coast Guard and the oil industry to respond successfully to oil spills in arctic areas (EPS 1978).

AMOP is managed by a Management Committee, chaired by Ken Meikle of EPS. This Committee, which has members drawn from COGLA, DFO, DIAND, CCG and EPS, sets priorities for funding. Several industry representatives sit as observers to the Committee. AMOP projects for 1984/1985 are listed in Table 3.5.

AMOP projects are conducted or managed by EPS staff at the River Road Environmental Technology Centre in Ottawa. This centre also conducts oil spill R and D for the Arctic Marine Transportation Program (AMTP)(Table 3-6).

One additional program to which the Technology Centre contributes is the Baffin Island Oilspill Project (BIOS). Expenditures for BIOS, with funding from EPS A-Base and from industry, are shown in Table 3-7 (in $K).

TABLE 3-5

EPS AMOP EXPENDITURES - 1984/1985

SUBJECT AREA	$K	p-y
Oil Spill Countermeasures		1
OHMSETT (EPS Contribution)	25	
Laser Ignition of Crude Oil	70	
Ultrasonic Burner	90	
High-Pressure Water Jets	40	
Arctic Field Manual	30	
Low-Energy Shorelines	30	
St. Lawrence River Manual	30	
KURDISTAN Incinerator Trial	3	
Oil Properties and Behaviour		1
Oil Properties	65	
Oil in Pack Ice	50	
Arctic Dispersant Test	50	
Sampling Plan Test	15	
Dispersant Laboratory Testing	5	
Dispersion Model	25	
Wave Energy Measurement	20	
Tidal Current Display	10	
Emulsion Prevention	50	
Oilspill Detection		0.4
Under Ice	50	
Remote Sensor Calibration	30	
Fraser Estuary		0.1
Dispersant Use	10	
Estuary Protection	30	
Oilspill Effects		0.2
Comparative Toxicology	20	
CCMOR and Handbook	50	
Dispersant Use Nearshore Workshop	10	
West Coast Risk Analysis	5	
Dispersant Workshop (French)	10	
Planning and Reporting		0.7
BIOS Support		0.8
ESRF Support		0.2
PERD Support		0.1
TOTAL	**824**	**4.4**

TABLE 3-6

EPS OILSPILL R AND D ACTIVITIES UNDER THE ARCTIC MARINE TRANSPORTATION PROGRAM - ($K)

	84/85	85/86
Unconfined In-situ Burning	49	
ONMSHETT Burning Trials in Ice Blocks	20	
Laser Ignition (field work)	50	
Dispersant Pre-Mixing (laboratory)	50	
Reporting	15	
Support (travel)	10	
TOTAL (1984)	194	
Laser Ignition Air-borne Test + Dispersant Full-Scale Ship Test		314
Personnel (p-y)	0.5	0.5

TABLE 3-7

BIOS EXPENDITURES 1984/85 - 1985/86 ($K)

	84/85	85/86
Publication of Year 4 Working Series and Scientific Paper for Issue of "Arctic"	150	
Shoreline Survey		100

EPS Atlantic Region, Dartmouth

Laboratory toxicity testing of drilling muds and seabottom sampling around well-sites on the Scotian Shelf are carried out by EPS -Atlantic. The toxicity testing program includes studies of both acute, short-term toxicity and long-term stress and behavioural changes induced in benthic organisms by drilling muds. Expenditures in these areas for 1984/85 are shown in Table 3-8.

TABLE 3-8

EPS ATLANTIC REGION R AND D EXPENDITURES 1984/85

Toxicological Testing of Oil-Based Drilling Muds	$30K (0.5 p-y)

EPS Western and Northern Region, Yellowknife

The EPS District Office in Yellowkife conducts or contracts a limited number of research and monitoring projects to support its regulatory and advisory activities in the Beaufort Sea and Arctic Islands. Current projects are listed in Table 3-9.

TABLE 3-9

EPS YELLOWKNIFE R AND D PROJECTS RELEVANT TO PERD 6.7
$K (p-y)

PROJECT	83/84	84/85	85/86
Cadmium Ecotoxicology	-	12	-
Marine Monitoring Advisory Capability	-	(0.1)*	(0.2)*
Arctic Marine Methods Manual	50 (0.1)	20 (0.1)	- (0.1)
TOTAL	**50** **(0.1)**	**32** **(0.2)**	**0** **(0.3)**

* O and M, Capital provided through NOGAP.

3.3 Energy, Mines and Resources

3.3.1 Canada Centre for Remote Sensing (CCRS)

Research and Development conducted by CCRS accrues benefits to many users and many areas of interest in Canada. Therefore, it is difficult to assign a realistic portion of each of CCRS programs to offshore oil and gas R and D. The following estimates (Table 3-10) are based on the percentage of benefits from the programs listed accruing to all offshore users and uses. These estimates were made by CCRS. The percentage accruing to offshore activities ranges from 50% to 5%, depending on the program. The portion of direct value to offshore oil and gas would be less than these figures.

TABLE 3-10

CCRS R AND D EXPENDITURES RELEVANT TO ALL OFFSHORE USERS/USES 1984/1985 - $K

Program	$K
Radarsat	2600
ERS1 (satellite)	1800
Ground Support for ERS1	500
Airborne Microwave 500 Airborne Operations	2000
Landsat Imagery Sales	250
CCRS O/H (20%)	1000
TOTAL	**8650**

3.3.2 Office of Energy Research and Development (OERD)

The OERD acts as the Secretariat to PERD. Bryan Cook is the Task 6 Coordinator. OERD support for Task 6 is $75 000 (including salary) and 1 p-y.

3.4 Department of Fisheries and Oceans

3.4.1 Ocean Science Affairs Branch

Allocation of funds for administration in support of energy-related R&D by Ocean Science Affairs Branch for 84/85, 85/86 and 86/87 is shown in Table 3-11.

TABLE 3-11

ACTIVITY	84/85	85/86	86/87
Administration (in Support of Energy-Related R and D) ($K) *	120	120	120

*includes salaries

3.4.2 Marine Environmental Data Services Branch (MEDS)

Allocation of funds for 84/85 - 86/87 by MEDS in support of energy-related R&D is given in Table 3-12.

TABLE 3-12

ACTIVITY	84/85	85/86	86/87
Wave Climate ($K) *	500	400	300
Archiving of Rig Data ($K)	10	20	25

*includes salaries

3.4.3 Fisheries Research Branch, St. John's

Research emphasis within this laboratory is on fisheries resource assessment and related activities. Such research leading to direct resource management advice comprises approximately 80% of the Branch resources. The remaining 20% includes some research related to offshore energy/environment issues.

Research program areas relevant to PERD 6.7 are:

(1) Oil pollution monitoring and impact assessment techniques;

(2) Oil pollution studies (documentation of oil spill incidents);

(3) Population biology of major commercial fish species that could be at risk from oil spills; and

(4) Ecosystem research and modelling.

Allocation of funds by subject area relevant to PERD 6.7 is outlined below and in Figure 3-2.

FRB ST. JOHN'S DISTRIBUTION OF RESOURCES BY SUBJECT AREA RELEVANT TO PERD 6.7 ($K)

SUBJECT AREA	83/84	84/85
Monitoring Techniques	43	18
Ecological Studies[1]	632	500
Oceanography/Climatology	42	95
TOTAL	717	613

1 Much of the resources under the subject area of ecological studies is directed at fisheries management, including: (1) management of fish stocks; (2) distribution and abundance of fish species; (3) fish habitat sudies; and (4) fish recruitment studies. Although not linked to PERD directly these studies do provide information that is necessary for the effective management of offshore oil and gas development.

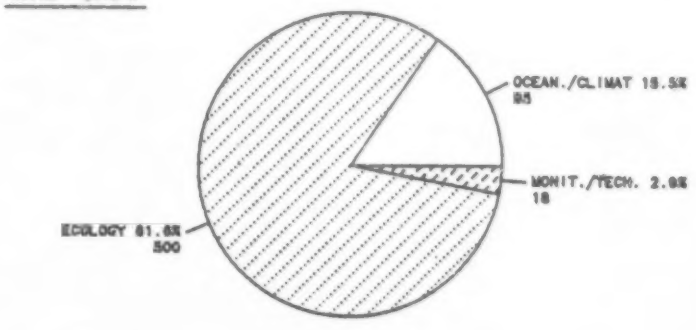


Figure 3.2. 1984/85 FRB St. John's Expenditures by Subject Area ($K) Subjects Relevant to PERD 6.7.

Tables 3-13, 3-14 and 3-15 list the A-Base resources for research relevant to PERD 6.7, A-Base resources committed to support of PERD projects, and other resources used in support of PERD projects, respectively.

TABLE 3-13

"A" BASE RESOURCES ALLOCATED TO RESEARCH RELEVANT TO TASK 6

Project Title	1983-84 Resources P/Y	O&M*	Capital	1984-85 Resources P/Y	O&M*	Capital
Hydrocarbon Sublethal Effects Toxicology	5.38	$ 98,160	$27,000	5.30	$63,400	$40,000
Population Ecology and Demography of Hooded Seals	1.90	$110,700	-	1.50	$94,000	-
Marine Ecosystems Research and Modelling	8.34	$346,730	$17,200	7.00	$267,800	$20,000
Oceanography/Ocean Climate	2.00	$ 26,700	$15,000	3.00	$75,000	$20,000

* Does not include costs associated with large research vessels (Departmentally owned or chartered).

TABLE 3-14

"A" BASE RESOURCES COMMITTED TO SUPPORT PERD TASK 6 RESEARCH ACTIVITIES
(DOES NOT INCLUDE COSTS OF RESEARCH VESSELS)

OERD Project Title/Number	1983-84 Resources P/Y	O&M*	Capital	1984-85 Resources P/Y	O&M*	Capital
Field Evaluation - Multivariable Biological Monitoring (67217)	-	-	$34,000	0.8	$ 4,000	$ 4,000
Impacts of Resource Development of Hooded Seals (67218)	-	$ 25,000	$ 8,000	-	$15,000	-
MFO Induction Measurements (67209)	-	$ 5,000	-	-	$ 5,000	-

* Allocations only

TABLE 3-15

NON "A" BASE RESOURCES * USED IN SUPPORT OF PERD TASK 6 RESEARCH ACTIVITIES

OERD Project Title/Number	1983-84 Resources P/Y	O&M*	Capital	1984-85 Resources P/Y	O&M**	Capital
Field Evaluation - Multivariable Biological Monitoring (67217)	1.00	$ 2,000	-	0.50	$ 3,000	-
Impacts of Resource Development on Hooded Seals (67218)	-	-	-	-	-	-
MFO Induction Measurements (67209)	0.20	$ 2,000	-	0.20	$ 2,000	-

* CEIC-sponsored Job Creation program
** Allocations only

3.4.4 Bedford Institute of Oceanography (BIO)

The Bedford Institute has four laboratories which conduct research and development which is relevant to PERD 6.7. These are:

(1) Atlantic Oceanographic Laboratory (AOL);

(2) Marine Ecology Laboratory (MEL);

(3) Canadian Hydrographic Service (CHS);

(4) Systems Engineering (IF).

Research is conducted at BIO to meet the needs of many government and industry users. All research projects have a per cent relevance to various issues/users assigned to them by the investigator. One of the categories is Offshore Oil and Gas. The attached histograms show the overall resources (in $K and in p-y) assigned to issue categories for AOL and for MEL (Figure 3-3). Two histograms show the regional distribution of resources for each of these two laboratories (Figure 3-4).

Projects with relevance to offshore oil and gas for all four laboratories are listed in Table 3-16. This table has been adjusted to remove funds contributed by PERD Task 6 (these funds are included in the PERD Task 6 project listings in Section 2.1 of the report). Table 3-16 also show the per cent relevance to oil and gas which has been assigned to each project. Table 3-17 shows total expenditures on projects having some relevance to PERD 6.7 activities; these should be considered upper limit values because the "per cent relevance" factors were <u>not</u> taken into account in the values shown.

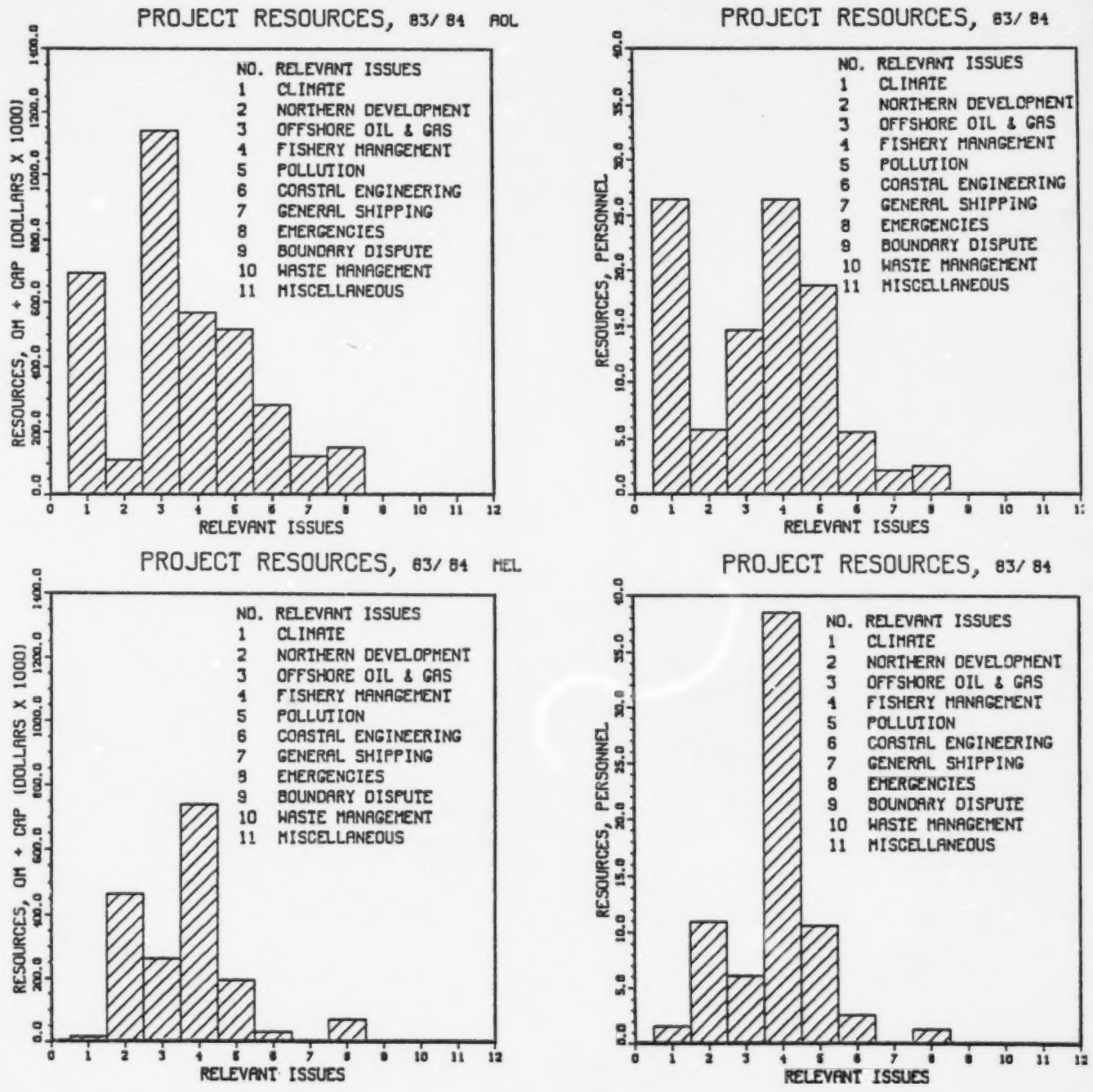


Figure 3-3. Overall resources ($K, left: P-Y right) assigned to R&D on relevant offshore issued by the Atlantic Oceanographic Laboratory (top) and Marine Ecology Laboratory (bottom) of the Bedford Institute of Oceanography.

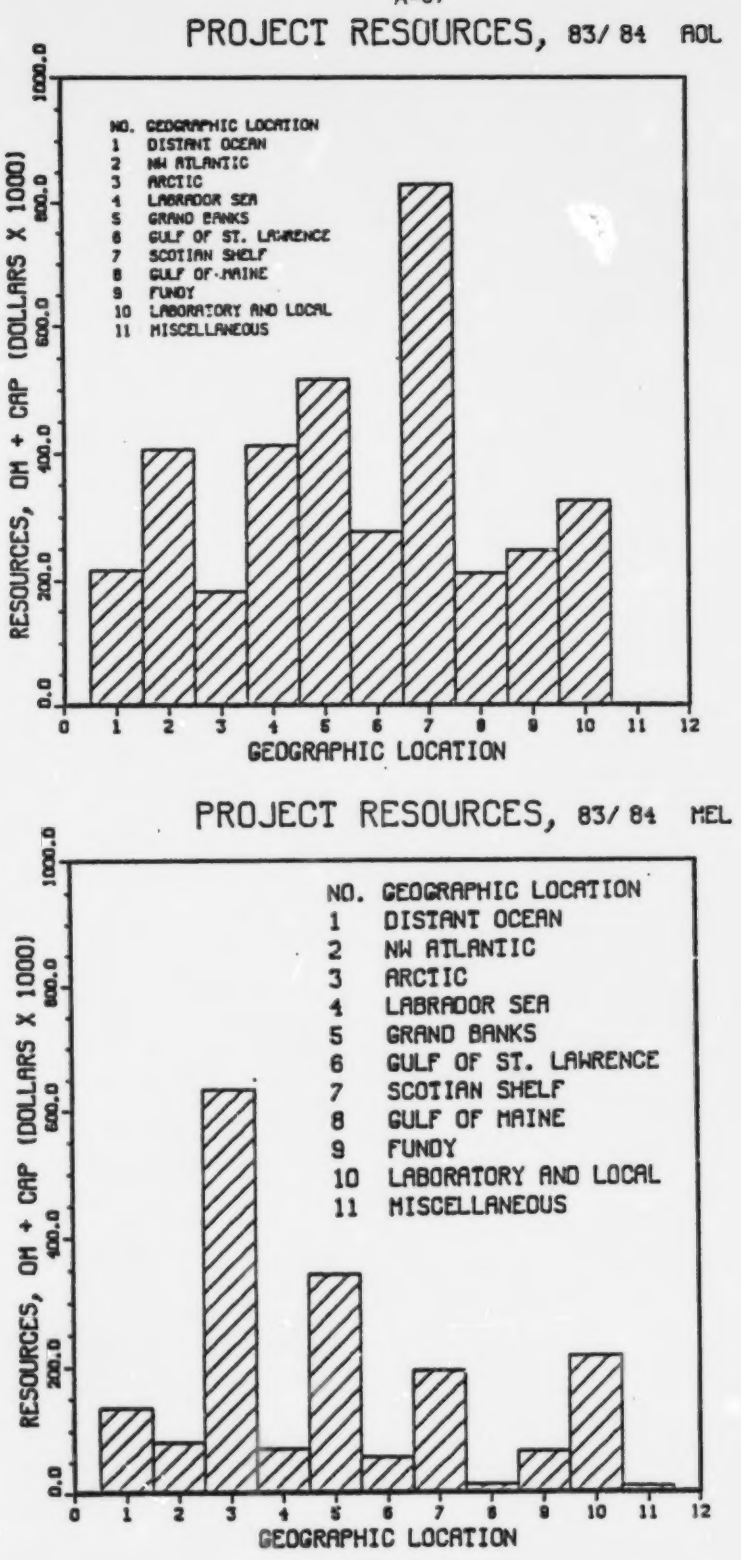


Figure 3-4. Regional distribution of R&D resources for the Atlantic Oceanographic Laboratory (top) and Marine Ecology Laboratory (bottom) of the Bedford Institute of Oceanography.

TABLE 3-16

PROJECT RESOURCES FOR 83/84 FOR RESEARCH RELATED TO OFFSHORE OIL AND GAS AT THE BEDFORD INSTITUTE OF OCEANOGRAPHY

Project	Topic Title	PY	Resources OM (K$)	Cap (K$)	Percent Relevance
I.	ATLANTIC OCEANOGRAPHIC LABORATORY (AOL)				
A	Wave Growth Studies	0.9	3.90	0.50	20.0
A	Wave Climate Studies	2.2	22.00	0.00	35.0
A	Oil Trajectory Analysis	1.7	182.00	0.00	60.0
A	Iceberg Drift Track Modelling	1.5	-	-	90.0
A	Gulf of St. Lawrence Ice Studies	1.2	6.00	-	20.0
A	Fronts at the Edge of Gulf Stream Rings	0.7	4.60	0.00	10.0
A	Sea Ice Dynamics - MIZEX	1.0	120.00	0.00	70.0
B	Labrador Current Variability	0.1	1.00	0.00	25.0
B	Northwest Atlantic Atlases	1.1	24.70	1.00	25.0
C	Cape Sable Experiment	1.0	0.60	0.00	15.0
C	Shelf Break Experiment	0.0	0.00	0.00	40.0
C	Shelf Dynamics-Avalon Channel Experiment	0.3	0.50	0.00	50.0
C	Tidally-Induced Mixing	3.2	0.00	0.00	75.0
C	Dynamics of Residual Circulation in the Gulf of Maine	0.2	0.50	0.00	30.0
C	Mixing and Circulation on Georges Bank	1.1	4.70	1.00	30.0
C	Browns Bank Experiment	3.8	124.00	58.00	10.0
D	Labrador Shelf and Slope Studies	0.0	1.60	0.40	20.0
D	Long-Term Monitoring of the Labrador Current at Transport Studies	1.5	25.80	19.00	30.0
D	Data Archiving	2.2	135	0.00	15.0
D	Development of Remote Sensing Facilities in the Atlantic Oceanographic Laboratory	0.8	29.20	12.00	20.0
D	Oceanography of the Newfoundland Continental Shelf	2.7	0.00	150.00	70.0
D	Eastern Arctic Physical Oceanography	0.5	30.00	0.00	30.0
D	Transport Through and in the Northwest Passage	0.3	0.40	0.00	20.0
E	Bay of Fundy Tidal Power-Studies in Physical Oceanography	0.1	0.10	0.00	10.0
E	Physical Behaviour of Particulate Matter and Sediments in the Natural Environment	1.2	30.40	0.00	5.0
E	Laboratory Studies of Particulate Matter	1.0	5.40	30.00	5.0
E	Bottom and Surface Drifters	0.5	5.00	0.00	10.0
E	Suspended Sediment Modelling	0.1	0.40	0.00	20.0
E	Modelling Historical Tides	0.1	0.10	0.00	45.0
E	Storm Surge	0.1	0.10	0.00	10.0
E	Circulation and Air-Sea Fluxes of Hudson Bay	0.5	0.50	0.00	30.0
F	Thermistor Chains on Drifting Buoys	0.4	2.30	0.49	10.0
F	The Dynamics of Primary and Secondary Production	0.1	0.74	0.16	10.0
F	Real-Time Data Acquistion	0.4	2.00	0.44	15.0
F	CTD Sensor Time Constant Measurements	0.1	0.50	0.11	10.0
G	Bottom Referenced Acoustic Positioning Systems	0.2	1.30	21.50	20.0
G	Ship Referenced Acoustic Positioning Systems	0.2	1.27	21.50	30.0
G	Multifrequency Acoustic Scanning of Water Column	0.8	4.60	5.50	20.0
G	Doppler Current Profiler	0.2	2.04	0.40	50.0
H	Mooring Systems Development	3.4	93.87	48.85	10.0
H	Handling and Operational Techniques for Instrument/Cable Systems	1.9	10.54	2.27	10.0
H	In-Situ Sampling of Suspended Particulate Matter	0.1	0.40	15.38	15.0
I	Chemical Pathways of Environmental Degradation of Oil	1.0	11.43	20.53	10.0
K	Dissolved Low Molecular Weight Hydrocarbons in Baffin Bay	0.5	0.10	0.00	50.0
K	Petroleum Hydrocarbon Components	0.5	3.48	0.00	20.0
K	Petroleum Residues in the Eastern Canadian Rctic	0.5	0.10	0.00	40.0
K	Background Levels of Petroleum Residues and Low Molecular Weight Hydrocarbons in the Labrador Shelf and Hudson Strait Regions	0.5	15.90	11.81	20.0
AOL Totals:		42.5	1339.00	421.00	

Project	Topic Title	PY	Resources OM (K$)	Cap (K$)	Percent Relevance
II	CANADIAN HYDROGRAPHIC SERVICE (CHS)				
H	Hydrographic Digital Data Base Management System Investigation	0.1	50.00	0.00	30.0
H	Bionav Development	1.0	10.00	10.00	20.0
H	Loran-C accuracy enhancement	1.0	65.00	5.00	10.0
H	UHF Positioning	1.0	5.00	-	15.0
H	Navstar Global Positioning System	0.1	200.26	0.00	10.0
H	Arctic Vertical Acoustical Sweep System	1.0	90.00	43.00	33.0
CHS Totals:		**4.2**	**420.00**	**58.00**	
III	SYSTEMS ENGINEERING (IF)				
ES	Plankton net control and data logging autonomous mode development	1.0	7.50	10.00	15.0
ES	Navigation interface micro computer unit	0.2	0.50	12.00	30.0
ES	Winch Performance Testing	0.1	2.00	0.00	15.0
ES	Oceanographic Winch	0.1	20.00	0.00	15.0
ES	Study of "personal computer" as applied to oceanographic research and hydrographic surveys	0.4	0.50	8.00	15.0
ES	Core handling arm	0.1	0.00	0.00	60.0
ES	Automatic spooling system for oceanographic winches	0.6	10.00	0.00	15.0
ES	Large Capacity Cable Tensioner	0.1	0.10	51.00	10.0
ES	Large Diameter Piston Corer	0.1	0.10	0.00	60.0
IF Totals:		**2.7**	**40.70**	**81.00**	
IV	MARINE ECOLOGY LABORATORY (MEL)				
A	Physiology and biochemistry of enzymes of photosynthesis	0.3	15.00	0.00	30.0
A	Respiration, nutrient uptake and regeneration in natural plankton populations	2.4	52.00	10.00	33.0
A	Physical Oceanography of selected features in connection with marine ecological studies	0.2	10.00	20.00	20.0
B	Carbon and nitrogen utilization by zooplankton and factors controlling secondary production	0.8	13.00	0.00	5.0
B	Development of profiling eqiupment (BIONESS and LHPR) for plankton and micronekton	1.6	13.00	0.00	15.0
B	Use of acoustic techniques to measure distribution of plankton and ichthyoplankton	0.4	7.80	0.00	10.0
B	Investigation of the biochemical composition of particulate organic matter in relation to digestion to zooplankton	1.1	26.00	15.00	10.0
B	Measurements of enzyme levels and their utility in estimating physiological rates and in determining physilogical stages	1.1	18.20	15.00	10.0
B	Feeding studies on zooplankton grown in an algal chemostat	0.2	1.30	0.00	10.0
C	Scotian Shelf Ichthyoplankton Program: data acquisition over large spatial and long temporal scales	0.0	0.00	0.00	20.0
C	Seasonal cycles of abundance and distribution of microzooplankton on the Scotian shelf	0.3	10.00	5.00	20.0
C	Comparison of methods of calculation of secondary production estimates from zooplankton population data	0.5	2.60	0.00	10.0
D	Physiology, production and distribution of marine phytoplankton	4.0	200.00	0.00	20.0
D	Distribution, growth, production, the role of diapause in Arctic zooplankton comunities	2.4	15.00	0.00	30.0
D	Zooplankton and micronekton of the eastern Arctic	0.2	1.30	0.00	20.0
D	Distribution and abundance of microzooplankton in the Arctic	0.5	13.00	0.00	50.0
E	Bioenergetics: Marine Mamals	0.5	8.00	0.00	20.0
E	Marine Mammal - Fisheries Interactions	0.5	2.00	0.00	10.0
E	Grand Banks Ecosystem Models	0.3	17	57.30	30.0
F	Water type analyses for the NAFO area	0.1	-	0.00	30.0
F	Oil distribution in relation to winds and currents following the breakup of the KURDISTAN	0.0	0.00	0.00	20.0
F	Halifax Section Historical Data	0.0	0.00	0.00	33.0
F	Climatic variability in the NAFO Area	0.2	2.00	0.00	20.0
F	Baffin Island Fjords	0.2	2.00	0.00	10.0
G	Dispersal strategies of marine fish larvae	1.0	10.00	1.00	20.0
G	Broad-scale spatial coherence of reproductive success among discrete stocks of capelin	1.0	1.00	0.00	20.0
H	Fate, metabolism, effects of petroleum hydrocarbons in marine environment	1.5	20.00	0.00	33.0
H	MFO in Winter Flounder	0.3	10.00	5.00	80.0
J	Mobility of trace metals and radionuclides in sediments	1.0	20.00	15.00	10.0
J	Vertical fluxes under the Arctic ice cap	0.5	20.00	0.00	30.0
MEL Totals:		**23.1**	**550.00**	**143.30**	

TABLE 3-17

ESTIMATE OF RESOURCES COMMITTED TO RESEARCH RELEVANT TO OFFSHORE OIL AND GAS AT THE BEDFORD INSTITUTE OF OCEANOGRAPHY 1983/1984

LAB	O and M($K)	CAP($K)	p-y	Ship($K)	Compu.($K)
AOL	910	421	42.4	1920	309
CHS	420	58	4.2	N/A *	N/A
IF	41	81	2.7	N/A	N/A
MEL	550	143	23.1	1277	N/A
TOTAL	1921	703	72.4	3197	309

* N/A = not available

Table 3-18 (and Figure 3-5) shows the distribution of R and D expenditures at the Bedford Institute of Oceanography relevant to PERD 6.7, by subject area. These subject areas do not coincide with BIO program (project) titles, but have been selected to correspond to PERD 6.7 areas of interest.

TABLE 3-18

EXPENDITURES BY SUBJECT AREA AT THE BEDFORD INSTITUTE OF OCEANOGRAPHY, 1983/1984 - R AND D RELEVANT TO PERD 6.7 ($K O and M plus Capital)*

SUBJECT AREA	EXPENDITURES
Waves and Currents	72
Physical Oceanographic Processes	584
Sea Ice and Icebergs	126
Ecological Studies	547
Monitoring and R and D Techniques Development (physical and biological)	818
Oil Spill/Oil Pollution Studies	266
Data Management	211
TOTAL	2624

*excludes salary and overhead; excludes PERD funds

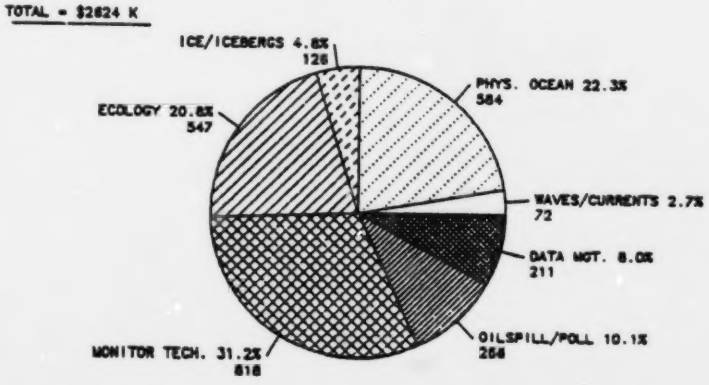


Figure 3-5. 1983/84 Bedford Institute Expenditures by Subject Area ($K) Subjects Relevant to PERD 6.7.

3.4.5 St. Andrews Biological Station, New Brunswick

TABLE 3-19

SUBJECT AREA	Expenditures $K (p-y)		
	83/84	84/85	85/86
Contaminants and Toxicology	2(.25)	2(.25)	2(.25)
Habitat Assessment and related research	2(.25)	2(.25)	2(.25)
Environmental Assessment	3(1.)	3(1.)	3(1.)
TOTAL	**7(1.5)**	**7(1.5)**	**7(1.5)**

3.4.6 Freshwater Institute (FWI), Winnipeg

TABLE 3-20

SUBJECT AREA	Expenditures $K (p-y)		
	83/84	84/85	85/86
Resource Impact	203 (9.5)	209 (9.5)	204 (9.5)
Habitat Research	84 (6)	105 (7)	130 (8)
Chemistry, Toxicology	31 (4.5)	31 (4.5)	128 (4.5)
TOTAL	**318 (20)**	**345 (21)**	**462 (22)**

Priorities

The Freshwater Institute held a workshop in November, 1984 to set research and monitoring priorities for offshore arctic regions where oil and gas development was likely to occur. The exercise was intended to assist FWI in identifying appropriate research topics for NOGAP funding. The priority areas for research and for monitoring arising from the workshop are listed in Table 3-21 (Arctic Laboratories Limited 1984).

TABLE 3-21

FRESHWATER INSTITUTE RESEARCH AND MONITORING PRIORITIES FOR OFFSHORE ARCTIC AREAS*

Research Priorities

1 Life history and population dynamics of the Arctic Cod (Beaufort Sea, Lancaster Sound)

2 Factors affecting the distribution of ringed seals in fast ice (Barrow Strait, Prince of Wales Strait, Amundsen Gulf)

3 Distribution and ecology of coregonids in the nearshore Beaufort Sea

4 Natural factors influencing the distribution, feeding and behaviour of bowhead whales (Beaufort Sea and Amundsen Gulf)

5 Factors influencing white whale distribution in the Mackenzie River estuary

6 Determination of critical pathways of contaminants and development of criteria for assessing biological significance (Tuktoyaktuk harbour)

Monitoring Priorities

1 Effect of industry activities on distribution and abundance of bowhead whales (Beaufort Sea)

2 Opportunistic study of the effects of oil spills on marine mammals and other biota (Tuktoyaktuk harbour, Resolute Bay)

3 Mortality and disruption of ringed seals related to icebreaking (Barrow Strait and Prince of Wales Strait)

4 Biochemical and behavioural effects of chronic spills and routine waste discharges at nearshore production facilities on anadromous and marine fish and their habitat (confined bays along Beaufort Sea coast)

5 Effects of vessel activities and associated noise on marine mammals (bowhead whale, white whale, narwal, bearded seal, ringed seal, walrus) (Beaufort Sea, Amundsen Gulf and Lancaster Sound)

* Results of a workshop held November 5-7, 1984 near Winnipeg.

3.4.7 Institute of Ocean Sciences, Sidney

SUMMARY OF IOS ACTIVITIES IN OCEANOGRAPHY AND OFFSHORE ENVIRONMENTAL PROCESSES AND IMPACTS FOR THE ARCTIC AND COASTAL BRITISH COLUMBIA

This section provides a brief description of the current and proposed research activities of IOS in relation to offshore energy developments in Arctic Canada and offshore B.C. Most of the information has been extracted from an internal IOS document "The Multi-Year Operation Plan (MYOP) for 1984/85 -1988/89". An update of this information will appear soon in the MYOP for 1985/86-1989/90.

GENERAL INFORMATION

Overall Statement of IOS Activities

The Pacific Region, Ocean Science and Surveys, is responsible for oceanographic and hydrographic survey of waters adjacent to the west coast of Canada and the western Arctic, and for a basic research program designed to improve understanding of physical, chemical, an ecological processes in the oceans and near-shore areas of concern to Canada.

IOS R&D Activities Related to Offshore Oil and Gas Developments

In the Arctic, in support of oil and gas exploration and transport, the Region is concentrating its efforts on the oceanography of the Northwest Passage and the interannual variability of currents and water temperatures as they affect extent and movement of ice. There is evidence that these variabilities are linked to other changes in the Arctic Ocean. A part of the field program is being carried out along the northern continental shelf of the Arctic Archipelago to investigate these linkages.

The region is also funded, through the Panel on Energy Research and Development, to carry out research leading to improvements in models for forecasting ice behaviour and improved predictions of ice conditions and movement in the Beaufort Sea.

Hydrographic survey of a ten mile wide transportation corridor through the Beaufort Sea has been completed. Planning with EMR for a geophysical/hydrographic survey along the boundary between Alaska and the Northwest Territories is progressing. This will be the high priority project for the next three years, although the region still plans to continue hydrographic survey of the Beaufort Sea as circumstances permit.

The Region has been orienting its hydrographic and oceanographic programs on the continental shelf to provide background information in support of the anticipated resumption of exploratory drilling for oil and gas. The activities include an extensive survey of tides and currents on the northern B.C. shelf, hydrographic/geophysical surveys with EMR (particularly in the Canada/US boundary areas), evaluation of historical oceanographic data, and in collaboration with the Marine Environmental Data Centre a study of wave conditions and modelling of tides and currents.

PRIORITY AREAS

The following have been identified by IOS as priority subjects for future R&D but no ranked order is provided.

- Westcoast Environmental Assessment
  - response to the Chevron and PetroCanada IEES.

- Arctic Oceanography and Environmental Studies
  - Beaufort Sea Shelf Dynamics

- Arctic Ecology

- Ocean Pollution
  - Toxic chemicals in the Marine environment.

- Arctic Chemistry
  - Role of Arctic in global cycles
  - Pollutant pathways in the Beaufort Sea
  - Natural variability record
  - Role of Arctic in ocean climate

- Hydrocarbon baseline in B.C. Coastal Waters
- Arctic Boundary Dispute Area
  - support for EMR in suporting the claim of the Canadian Government.
- Western Arctic and Pacific Regional Marine Use Planning
- Environmental Monitoring
  - Assessment Techniques

ALLOCATION OF RESEARCH FUNDS

The allocation of research funds at IOS relevant to PERD Task 6.7 are shown by subject area (Table 3-22 and Figure 3-6) and by geographic region (Table 3-23 and Figure 3-7). A-base and non-PERD expenditures on subjects relevant to PERD Task 6.7 are summarised in Table 3-24.

TABLE 3-22

DISTRIBUTION OF IOS R AND D EXPENDITURES BY SUBJECT AREA 1984/1985 -PROJECTS RELEVANT TO PERD 6.7 ($K)

SUBJECT AREA	$K
Physical Oceanography (Ocean Physics)	794
Marine Ecology (Ocean Ecology)	47
Chemical Oceanography (Ocean Chemistry)	131
Data Management(Ocean Information)	85
TOTAL	1057

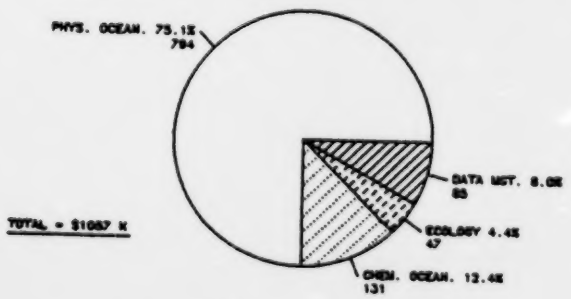
TABLE 3-23

DISTRIBUTION OF IOS R AND D BY REGION 1984/1985 - PROJECTS RELEVANT TO PERD 6.7 ($K)

REGION	$K
West Coast	234
Arctic	718
Not Specified	105
TOTAL	1057

Figure 3-6. 84/85 Institute of Ocean Sciences Expenditures by Subject $K Subjects Relevant to PERD 6.7

Figure 3-7. 84/85 Institute of Ocean Sciences Expenditures by Region $K Subjects Relevant to PERD 6.7



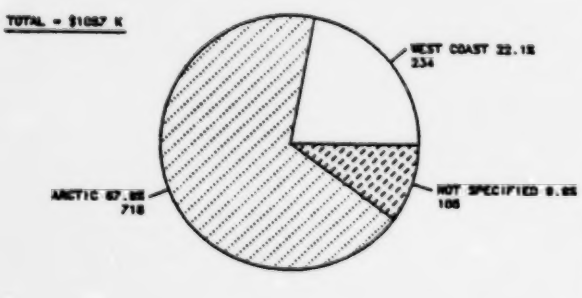


TABLE 3-20

INSTITUTE OF OCEAN SCIENCES - EXPENDITURES ON RESEARCH RELEVANT TO PERD 6.7: A-BASE AND OTHER NON-PERD ($K O and M + Capital -1984/85)*

SUBJECT AREA	$K	(p-y)
OCEAN PHYSICS		
Program: Fjords and Narrow Channels		
Prince of Wales Strait	9*	(0.3)
Program: Oceanography of Continental Shelf and Margin		
Arctic Archipelago	333*	(4.0)
Queen Charlotte Is.	70	(1)
Arctic Archipelago Shelf	133	(3.5)
Hecate Strait	0	-
Program: Upper Layer Processes		
Ice Boundary Layer (lab) (PERD Project)	33	(2.8)
Program: Development and Application of Forecasting Methods		
North Coast Tides (B.C. Coast)	14.5	(0.25)
Northwest Passage Tides (PERD Project)	1	(0.1)
OCEAN ECOLOGY		
Program: Description of Planktonic Ecosystems		
Hecate Strait/Queen Charlotte	5.5	-
Program: Physical/Biological Coupling		
Analysis of Satellite Imagery	N/A	-
Mesoscale Plankton Variability	2.2	-
Smallscale Plankton Variability	39	(2)
OCEAN CHEMISTRY		
Program: Ocean Pollution		
Western Arctic Baseline and Biogeochemical Processes	NOGAP	-
Hydrocarbons, B.C. Coast	33	-
Sedimentary Processes in B.C. Fjords	33	-
		-
Program: Ocean Fluxes		
Chemical Fluxes Models (N.E. Pacific)	50	-
Chemical Flux Rates (Simulated)	15	-
Chemical Fluxes Model (Juan de Fuca Slope and B.C Shelf)	N/A	-
Under-ice sediment trap system	N/A	-
Chemical fluxes model (Arctic)	N/A	-
Program: Ocean Circulation		
Beaufort Sea Water Masses	N/A	-
OCEAN INFORMATION		
Program: Ocean Information		
Data Catalogues	69	(0.2)
Description of IOS Data Set Program	6	-
Data Assessment (PERD Project) (PERD Project)	10	(0.1)

* Transport R and D + A-Base
N/A = not available

3.5 Indian and Northern Affairs Canada

3.5.1 Environmental Studies Division, Northern Environment

The Northern Environment Branch of INAC manages offshore environmental research related to oil and gas activities. The objective of this research is to provide the department with necessary information for regulation and decision-making on northern development. The Environmental Studies Division in 1983/1984 provided seed money, and in some cases a considerable portion of the funds, through the Arctic Land Use Research Program (ALUR), for offshore environmental studies. The overall level of funding under ALUR is approximately $450 000 per year, most of it for terrestrial or non-oil-related research. The Division is currently relying on other sources of funding, such as NOGAP and ESRF, to meet its offshore research needs. In fiscal year 1984/1985 no ALUR funds have been allocated to offshore research.

Table 3-25 lists research managed by Environmental Studies Division which is relevant to PERD 6.7

TABLE 3-25

ENVIRONMENTAL STUDIES DIVISION, INAC - EXPENDITURES FOR RESEARCH RELEVANT TO PERD 6.7 ($K)

PROJECT	FUNDING	83/84	84/85
Responses of Marine Mammals to Arctic Marine Transportation			
Phase 1	ALUR	60	
	other	93	
Phase 2	ALUR	60	
	other	74	
Phase 3	NOGAP	-	36
		287	36
Remote Sensing of Phytoplankton Distribution in Beaufort Sea as an Indication of Bowhead Whale Distribution	ALUR	5	
	other	91	
		96	
Beaufort Environmental Monitoring Project	ALUR	145	
	EC	15	
	DSS/UP	259	
	NOGAP	—	140
		419	140

3.5.2 Beaufort Environmental Monitoring Project (BEMP)

BEMP is a research management project designed to identify environmental monitoring priorities related to oil and gas development in the Beaufort Sea, and to provide a reiterative mechanism for updating research and monitoring programs. BEMP uses technical meetings and workshops involving government, industry, university and consultant research managers and scientists to achieve its objectives.

Long-Term Objective

The long-term objective of BEMP is "to provide Indian and Northern Affairs Canada and Environment Canada with the technical basis for design, operation and evaluation of a comprehensive and defensible environmental research and monitoring program to accompany hydrocarbon development activities in the Beaufort Sea region." (LGL, ESL and ESSA 1984).

The objective and end result of year one (1984) of the BEMP exercise was a report which provided a defensible outline for research and monitoring activities in the Beaufort Sea. Research and monitoring requirements were defined and presented in the form of scientific hypotheses, which monitoring programs are designed to test. Research is to be conducted if the state of knowledge of components of the environment is not sufficient to allow a monitoring program to test a hypothesis adequately .

The objective of year two (1985) of BEMP is "to review and synthesize the existing body of information in order to provide recommendations on progress towards achievement of established research and monitoring objectives (existing hypotheses and linkages), changes to hypotheses, and changes in the direction of the recommended research and monitoring programs" (Duval and Birdsall 1985).

The recommended research projects, relevant to PERD 6.7, which resulted from year one of BEMP (LGL, ESL and ESSA 1984) are listed in Table 3-26. In addition, all current and proposed research and monitoring studies which have been identified as being relevant to BEMP (and therefore to Beaufort Sea oil production and marine transportation) (Duval and Birdsall 1985) are shown in Table 3-27. A number of these studies have been identified elsewhere in this report under funding sources such as ESRF and NOGAP.

TABLE 3-26

BEMP 1984 - RECOMMENDED RESEARCH AND MONITORING FOR THE BEAUFORT SEA (SUBJECTS RELEVANT TO PERD 6.7)

Research

1 Summer/winter energy balance dynamics of western Arctic bowhead whales; distribution of food supply; acoustical development of behavior monitoring methods

2 Factors controlling distribution of white whales in Niakunak Bay and Kugmallit Bay

3 Ice stability research in Amundsen Gulf; further analysis of ringed seal samples in relation to ice conditions

4 Data on ice cover and ringed seal populations in Amundsen Gulf (1971-1983) should be examined for correlations between population parameters and ice conditions

5 Support of existing research on polar bear detection and deterrents

6 Research into sources of tainting in fish; this research is necessary only if monitoring of fish around shorebases or shallow-water production facilities identifies tainting

Monitoring

1 Annual distribution of bowheads and behavioural responses to industry activities; reproductive success; ambient noise

2 Annual monitoring of regional landfast ice extent, distribution and breakup; continuation and revision of white whale monitoring

3 Aerial photography of icebreaker traffic/ice regime in Amundsen Gulf; possible remote sensing of ringed seal birth lairs; (these recommendations dependant on research results)

4 No monitoring recommended, pending research results

5 Continued support of current polar bear monitoring studies

6 Time series measurements of hydrocarbons in fish from Tuktoyaktuk harbour; possible taste testing and caged fish studies

7 Regular observation of bird abundance, distribution and mortality at offshore islands (and shorebases)

TABLE 3-27

CURRENT AND PLANNED OFFSHORE ENVIRONMENTAL RESEARCH ACTIVITIES (ALL SOURCES OF FUNDING) RELEVANT TO BEAUFORT SEA OIL PRODUCTION AND TRANSPORTATION AND TO PERD 6.7

PROJECT	ORGANIZATION	FUNDING SOURCE
1984 Beaufort Sea Bowhead	ESL (consultant)	ESRF Monitoring
Feasibility Study for Factors Determining Bowhead Distribution	LGL (consultant)	ESRF
Long-term Effects of Industrial Activity on Bowhead Whales	LGL	DSS; NOGAP (INAC,DFO)
Underwater Detection/Census of Marine Mammals	DFO/FWI	PERD; DFO
Remote Sensing Techniques for Marine Mammals	DFO/FWI	PERD; DFO
Beaufort Sea White Whale Study (for management)	DFO/FWI	DFO; NOGAP
1984 Offshore Beaufort Sea White Whale Monitoring	P.N. Research (consultant)	NOGAP
Reaction of White Whales and Narwhals to Ship Traffic and Ice Breaking		industry and INAC
1984 SAR Ice Imagery of the Beaufort Sea	oil industry	oil industry
1984 Beaufort Seal Monitoring Study	DFO/FWI	ESRF; DFO
Changes in the Population Dynamics of Ringed Seals in Amundsen Gulf	DFO/ABS	N/A
Effects of M.V. Arctic Ship Track on Hunter Travel	FMS (consultant)	NOGAP
Field Evaluation of I.R. Detection for Surveying Marine Mammals	Compuheat (consultant) PERD; industry	DFO; INAC;
Study of Arctic Cod and its importance in arctic food chains	LGL	DSS; DFO; INAC
Fish Feeding Ecology	DFO/FWI	DFO; NOGAP
Bear Deterrent Program	GNWT Renewable Resource	government and industry
Behaviour of Oil in Ice	D.F. Dickens (consultant)	EPS (AMOP)
Experimental Oil Spills on East Coast	D.F. Dickens and S.L. Ross (consultant)	ESRF
Tainting of Fish Resources (Paper study)	Martec (consultant)	ESRF
Nearshore Benthic Monitoring	DFO/FWI	DFO; NOGAP
Mackenzie Shelf Fisheries Habitat	DFO/FWI	DFO; NOGAP

*Source: Duval and Birdsall 1985

3.6 Natural Sciences and Engineering Research Council of Canada (NSERC)

NSERC is a federal government funding agency which provides research funds for Canadian university faculty and students.

Objectives

(1) To promote research in the natural sciences and engineering.

(2) To encourage R and D links between universities and industries.

(3) To train competent scientists and engineers.

Funding Programs

NSERC has several funding programs. Two of these provide major research funding to universities: operating grants and strategic grants.

Operating grants are the core of NSERC's funding to universities. These grants allow researchers to employ assistants, pay stipends to graduate students and purchase research equipment.

Strategic grants are given to university researchers to allow them to focus on problems of national concern. This program has seven areas targetted for accelerated research.

(1) Energy

(2) Oceans

(3) Environmental Toxicology

(4) Industrial Materials and Processes

(5) Biotechnology

(6) Communications and Computers

(7) Food/Agriculture

Strategic grants and operating grants awarded in 1984/1985 which are relevant to PERD 6.7 were identified through a computer search of the NSERC grants files. NSERC grants by subject area and region where the research was conducted are shown in Table 3-28 and Figure 3-8, and Table 3-29 and Figure 3-9, respectively. Relevant research being conducted at Canadian universities is listed in Table 3-30 and 3-31.

TABLE 3-28A

NSERC STRATEGIC GRANTS: AWARDS BY SUBJECT AREAS RELEVANT TO PERD 6.7 ($K)

SUBJECT AREA	AWARDS 1984/1985
Oceanographic Processes and Non-Specific Physical Oceanography	252
Sea Ice and Icebergs	399
Marine Ecology	278
Oil Fate and Effects	129
TOTAL	1058

TABLE 3-28B

NSERC OPERATING GRANTS: AWARDS BY SUBJECT AREAS RELEVANT TO PERD 6.7 ($K)

SUBJECT AREA	AWARDS 1984/1985
Weather	23
Waves	66
Oceanographic Processes and Non-Specific Physical Oceanography	348
Sea Ice and Icebergs	75
Marine Ecology	347
TOTAL	859

TABLE 3-29A

NSERC STRATEGIC GRANTS: AWARDS BY REGION FOR SUBJECT AREAS RELEVANT TO PERD 6.7 ($K)

REGION	AWARDS 1984/1985
East Coast and Labrador Coast	262
West Coast	53
Arctic	121
Non-Specific or Not Stated	622
TOTAL	1058

TABLE 3-29B

NSERC OPERATING GRANTS: AWARDS BY REGION FOR SUBJECT AREAS RELEVANT TO PERD 6.7 ($K)

REGION	AWARDS 1984/1985
East Coast and St. Lawrence	406
West Coast	164
Arctic	22
Non-Specific or Not Stated	267
TOTAL	859

Figure 3-8. 84/85 NSERC Strategic and Operating Grants by Subject ($K) Subjects Relevant to PERD 6.7.

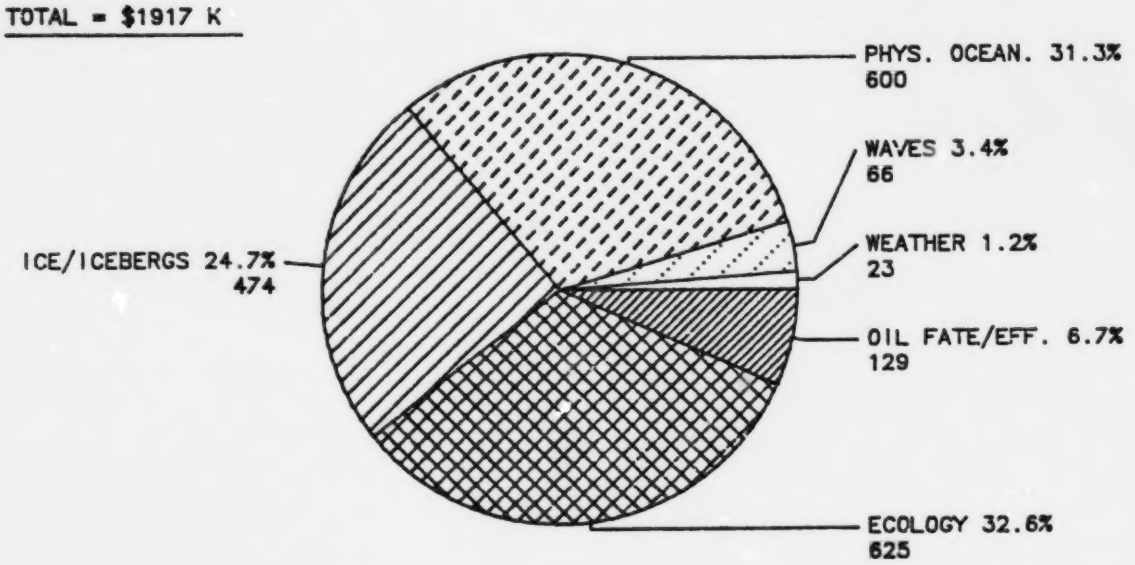


Figure 3-9. 84/85 NSERC Grants by Region where Research conducted ($K) Subjects Relevant to PERD 6.7.

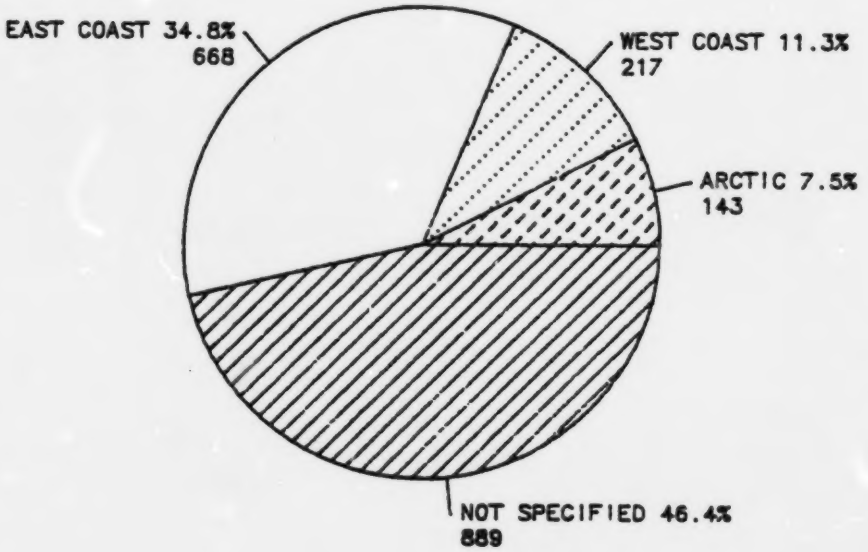


TABLE 3-30

NSERC STRATEGIC GRANTS IN SUBJECT AREAS RELEVANT TO PERD 6.7 - 1984/1985 ($K)

OCEANOGRAPHIC PROCESSES AND NON-SPECIFIC PHYSICAL OCEANOGRAPHY			
Digital Acoustic Release System	R.G. Ingram	McGill	45
Low Frequency Velocity and Density Variations in Strait of Georgia	G.S.Pond	B.C.	53
Salt Finger and Diffusive Fluxes at Low Stability Ratio	B.R. Ruddick	Dalhousie	33
Wave Induced Diffusion	B.G. Sanderson	Memorial	7
Source, Nature and Size Distribution of Particles in the Ocean	P.J. Wangersky	Dalhousie	114
ICE			
Ice Rubble Mechanics	N. Morgenstern	Alberta	98
High Frequency Radars for Detection of Sea Ice	J. Walsh R. Winsor	Memorial C-CORE	90
Hazard Potential of Glacial Ice Masses Offshore Newfoundland and Labrador	J.H. Lever	Memorial	118
Sea Ice Dynamics	J.F. Sykes	Waterloo	93
MARINE ECOLOGY			
Plankton Rate Processes in Oligotrophic and Coastal Oceans	R. Knoechel	Memorial	26
Taxonomie et Ecophysiologie des diatomees marines benthiques de substrat dur	A. Cardinal	Laval	33
Biological Recolonization Rate in Iceberg Scours	R. Haedrich	Memorial	28
Hydrodynamic Control of Micro-algae and Particulate Matter under Sea Ice	R.G. Ingram	McGill	163
Flux of Cadmium through an Arctic Marine Ecosystem	J.B. Sprague	Guelph	28
OIL FATE AND EFFECTS			
Toxic and Carcinogenic Effects of Petroleum Oils	A. Rahimtula	Memorial	69
Formation d'emulsions et dispersion des huiles dans l'eau de mer	J.E. Desnoyers	INRS Quebec	60

TABLE 3-31

NSERC OPERATING GRANTS IN SUBJECT AREAS RELEVANT TO PERD TASK 6.7 - 1984/1985 ($K)

WEATHER			
Short-term Variability in Wind and Sea Surface Temperature	W.J. Emery	B.C.	23
WAVES			
Dynamics of Waves, Currents and Sediments	A.J. Bowen	Dalhousie	46
Waves and Thermal Stratification in Large Bodies of Water	M. Rahman	T.U.N.S.	3
Ocean Waves and Coastal Oceanography	P.H. Leblond	B.C.	17
OCEANOGRAPHIC PROCESSES AND NON-SPECIFIC PHYSICAL OCEANOGRAPHY			
Circulation Dynamics and Mixing Processes in Estuaries	M. El-Sabh	Quebec	20
Satellite Tracking Antenna and Image Analysis Facility	W.J. Emery	B.C.	61
Physical Oceanography	C.J.R. Garrett	Dalhousie	70
Coastal and Continental Shelf Oceanography	A.E. Hay	Memorial	27
Nearshore Processes and Boundary Layer Dynamics	D.A. Huntley	Dalhousie	31
Logistic Support for Winter Oceanographic Work Hudson Bay	R.G. Ingram	McGill	6
Effect of Environmental Changes on Estuarine Circulation and Mixing	R.G. Ingram	McGill	18
Ocean Waves and Coastal	P.H. Leblond Oceanography	B.C.	17
Dynamical Oceanography	L.A. Mysak	B.C.	29
Inlet and Coastal Circulation, Dynamics and Mixing	G.S. Pond	B.C.	36
Role of Interleaving in Ocean Mixing	B.R. Ruddick	Dalhousie	13
Continental Shelf Dynamics	I.T. Webster	Memorial	12
Biological Oceanography, Arctic,Gulf of St. Lawrence and North Atlantic	M.J. Dunbar	McGill	8
SEA ICE AND ICEBERGS			
Mecanique et dynamique des Glaces	B. Michel	Laval	60
Etude Theoretique et Experimentale du fluage de Polytechnique la glace marine	J.R. Murat	Ecole	15
MARINE ECOLOGY			
Feeding of Euphausiids	C.M. Boyd	Dalhousie	23
Ecologie et Ecophysiologie des diatomees benthiques de substrat dur en milieu marin	A. Cardinal	Laval	40
Energetics and Feeding Mechanisms of Cold-Ocean Tunicates	D.R. Deibel	Memorial	18
Plankton and the Physical Environment off S.W. Nova Scotia	R.O. Fournier	Dalhousie	7
Size Structure in Oceanic Assemblages	R. Haedrich	Memorial	31
Nutrient Uptake, Growth and Species Competition in Marine Algae	P.J. Harrison	B.C.	27
Relationship between Phyto-plankton Biology and Turbulent Mixing in Marine Environment	L.A. Hobson	Victoria	20
Microbiology of Marine Sediment-Water Interfaces	J.A. Novitsky	Dalhousie	31
Partitioning of Energy Resources between Zooplankton and Zoobenthos	J.C. Roff	Guelph	29
Energy Fluxes from Epontic and Plankton Ice Communities to Benthos	J.C. Roff	Guelph	12
Marine Algal Flora	R.F. Scagel	B.C.	24
Marine Algae of the North Atlantic Ocean: the Amphi-Atlantic Question	G.R. South	Memorial	63
Marine Fungi of Hudson Bay	J.T. Booth	Manitoba	12
Ecology of Marine Intertidal and Shallow-Water Animals	D.H. Steele	Memorial	26

4. PROVINCIAL DEPARTMENTS RESEARCH AND DEVELOPMENT

4.1 NEWFOUNDLAND AND LABRADOR PETROLEUM DIRECTORATE

Objectives

The Petroleum Directorate is not a research department. However, it funds contract studies and, to a lesser degree, conducts in-house studies to support its regulatory role.

Links

The Petroleum Directorate maintains links with federal and other provincial research funding agencies through representation on programme committees. The Directorate has a representative on each of the ESRF Programme Study Committees (except Social Studies West). It is represented on the AES Climate Advisory Committee for Newfoundland/Labrador. The Directorate also attends federal seminars on such topics as offshore oil-based mud use.

Priorities

The Directorate has input to offshore environmental R&D priority setting through its membership on the ESRF Programme Study Committees. Those of its priorities which are not met by federal funding sources focus mostly on the nearshore environment. Specific research areas are:

(i) Biological monitoring in the nearshore;

(ii) Environmental monitoring of chronic disturbances; and

(iii) Oilspill fate/fisheries effects modelling.

Research and Development Project Funding

The Petroleum Directorate commits approximately 33% to 50% of the time of its Production Engineering staff to supporting contracted R&D. This works out to between 2 and 3 p-y. It expects to spend another 15% to 20% of its time fulfilling its role on the ESRF Programme Study Committees. Expenditures made by the government of Newfoundland and Labrador during the period 1981-1985 for projects relevant to PERD 6.7 are shown by subject area in Table 4-1 and Figure 4-1. A list of projects already conducted and those projected for 1985 are given in Table 4-2.

TABLE 4-1

NEWFOUNDLAND AND LABRADOR PETROLEUM DIRECTORATE EXPENDITURES FOR PROJECTS RELEVANT TO PERD 6.7 - 1981-1985 BY SUBJECT AREA

SUBJECT AREA	$K
Wind and Wave	12
Sea Ice and Icebergs	25
Monitoring Techniques	40
Oilspill	20
Data Analysis/Archiving	15
Marine Engineering	295
TOTAL	**407**

Figure 4-1. 1981-85 Newfoundland and Labrador Petroleum Directorate Expenditures ($K). Subjects Relevant to PERD 6.7.

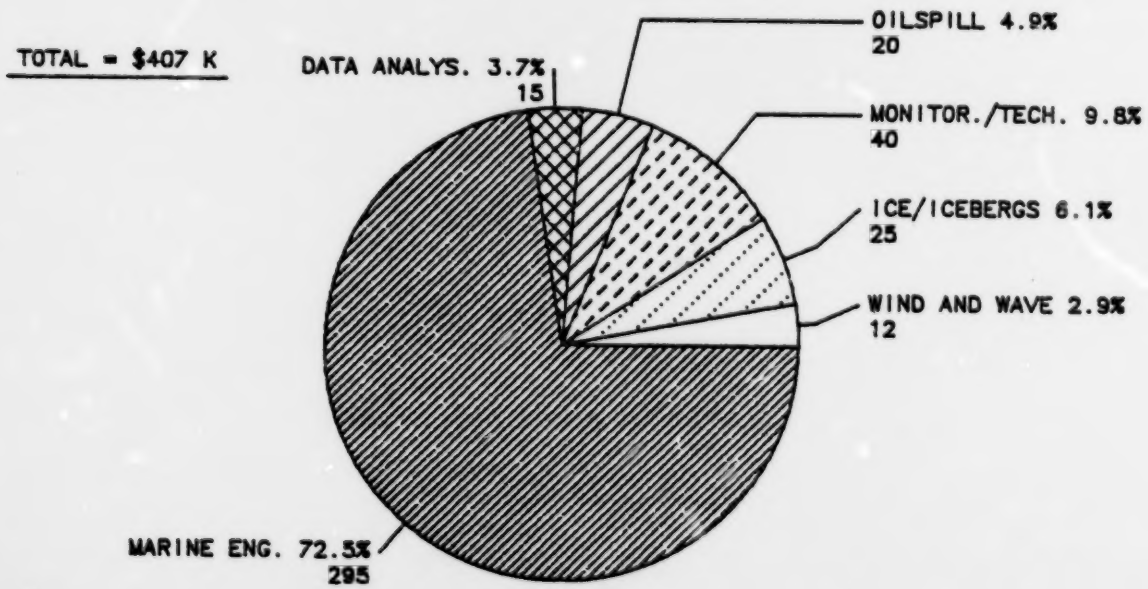


TABLE 4-2

NEWFOUNDLAND AND LABRADOR PETROLEUM DIRECTORATE
PROJECTS RELEVANT TO PERD 6.7
CONDUCTED (1981-1984) AND PROPOSED (1985)*

TITLE	COST ($K)	YEAR
Iceberg and Pack Ice on the Grand Banks: Production Considerations	10	1981
Risk Analysis of Semi-Submersible Operations on the North-East Grand Banks	35-40	1982
Iceberg Ice: Physical Characteristics, Uniaxial Compression Testing	10	1982
Radar Configuration, Guidelines for Iceberg Detection from Offshore Drilling Platforms	15	1982
Evaluation Methodology for the Engineering Assessment of the Hibernia Development Plan	70	1982
Wind Speed and Wave Height Statistics for Hibernia	7	1982
Long-Term Forecast to Sea, Ice, Icebergs and Weather on the Grand Banks	10	1982
Influence of Small Icebergs on Semi-Submersibles	50	1983
Risk Analysis of Dynamically Positioned Drill Units Operating Offshore Labrador	35	1983
Engineering/Environment Data Archive: a Recommended Design*	15	1983
Iceberg Detection Capability (using on-rig radar)	8-10	1983
The Influence of Ice on the Reliability of a Floating Early Production System on the Hibernia Field	50	1984
A Study on the Reliability of a Floating Early Production on the Hibernia Field	50-60	1984
Evaluation of Biological Shoreline Communities (identification of information for monitoring; assessment of appropriate monitoring schemes; assessment of research/data to date)	40	1985
Evaluation of Oil Spill Fate/Fisheries Models (applicability of existing models to Grand Banks; data requirements for oceanographic, fate and fisheries population model components)	20	1985
Severity of Sea Ice in Newfoundland Bays (Atlas of Ice Conditions)	25	1985
Literature Review of Marine Resources of Southeast Newfoundland**		1984

* Now using AES data archive

**Newfoundland Department of Development

4.2 GOVERNMENT OF NOVA SCOTIA

Discussions with representatives of the Nova Scotia Department of Environment and the Nova Scotia Department of Fisheries indicated that the province does not directly fund or engage in offshore environmental research. There are several reasons for this.

(1) The Canada/Nova Scotia agreement on offshore oil and gas resources appears to assign the responsibility for such research to the federal government.

(2) The province does participate in federal environmental reviews and on environmental committees, through which it can make its research priorities known.

(3) The limited funds available for environmental issues in the province are directed into environmental management and into fisheries resources research.

The Nova Scotia Department of Fisheries is focussing its current research efforts on nearshore fisheries issues such as aquaculture, studies of juvenile lobster and research into gaspereau and herring.

4.3 GOVERNMENT OF BRITISH COLUMBIA

SUMMARY OF THE GOVERNMENT OF B.C. ACTIVITIES IN OCEANOGRAPHY AND OFFSHORE ENVIRONMENTAL PROCESSES AND IMPACTS FOR COASTAL BRITISH COLUMBIA

At present the Province of British Columbia has no budget to conduct R&D into offshore energy issues independently. The Province does, however, participate jointly with most Federal Government programs into wind/wave/current forecasting and ecological process studies.

A tentative list of priority items is given below. An out-of-date list of information priorities is provided in Table 4-3 taken from the Preliminary Environmental Assessment prepared by the Province of B.C. in 1983. This list should be used for general information purposes only. A complete and up-to-date list is expected to be the output of a scoping exercise scheduled for spring 1985.

(1) Birds - distributions
- population distribution away from nesting areas

(2) Oil Spills
- identify needs and responsibilities for offshore
- sensitivity mapping
- set policy on use of dispersants

(3) Methodologies - develop impact assessment framework

(4) Salmon - effects of oil

(5) Herring - effects of oil, particularly on nearshore areas.

The following studies are on-going in the B.C. Coastal Region:

(1) Social Issues West (funded in 1984/85 by ESRF)
(2) Wave Climate Study (funded in 1984/85 by ESRF)

TABLE 4-3.

PRIORITIES FOR PHYSICAL, CHEMICAL AND BIOLOGICAL DATA IN OFFSHORE BRITISH COLUMBIA

Examples of the kinds of data used to guide environmental management of offshore developments. The importance of the data to various phases of management is suggested by priority numbers. Priority values are based on the importance of the data in planning for the phases indicated at the heads of the columns. Priorities are: 1 - Essential; 2 - Valuable (i.e., should be collected if possible); 3 - Useful (i.e., worth collecting); 4 - Needed only for scientific completeness; and 5 - Irrelevant (i.e., data not collected routinely). (After MacLaren Plansearch, 1982).

	WEST COAST				COMMENTS
	Design and Operation	Contingency	Impact Assessment	Impact Monitoring	
METEOROLOGICAL DATA					
Wind					
speed	1	1	1	5	Continuous records for analysis of coherence with shore-based stations.
direction	1	1	1	5	
Air					
temperature	2	1	2	5	
humidity	3	3	3	5	
clouds	2	2	3	5	
fog	2	2	3	5	Can be important because of its affect on visibility.
precipitation	5	5	4	5	
icing potential	1	1	4	5	
Irradiance	5	2	4	5	Affects weathering, biological processes, but can be derived from cloud, and fog data.
PHYSICAL OCEANOGRAPHIC DATA					
Water					
temperature	3	1	1	5	Collect data throughout water column continuously with a quality CTD. Important for determining circulation.
salinity	5	5	1	5	
Current					
speed	1	1	1	5	Speed and direction should be measured concurrently with temperature, salinity and wind speed and direction at numerous sites, depths and over time periods long enough to resolve sub-tidal, tidal and supra-tidal components and to determine general circulation patterns (cf. Cannon 1978, Holbrook et al., 1980).
direction	1	1	1	5	
drift card studies	5	1	1	5	
tracked surface drifters	5	1	1	5	
Wave					
height	1	1	1	5	Can be calculated from wind speed, fetch and duration but can be modified by bottom topography and current, at drilling site.
period	1	1	1	5	
Internal waves	3	3	2	5	
Sea surface elevation	1	1	1	5	Potentially important to distribution of pollutants and biological processes.
Geomorphology, especially substrate type	5	1	1	5	Needed for input into circulation, slick trajectory, etc. models and for resolution and prediction of low frequency motions.

	WEST COAST				COMMENTS
	Design and Operation	Contingency	Impact Assessment	Impact Monitoring	
CHEMICAL OCEANOGRAPHIC DATA					
Nutrient Concentrations	5	3	3	5	
Suspended Particulate Matter	5	3	3	3	
Pollutant Concentrations					In water, sediments and biota
trace and heavy metals	5	5	4	2	Quantities discharged usually negligible because of dilution. Identifiable toxic chemicals used routinely on rig including lubricants, cleaners/ disinfectants etc. Also includes toxic hydrocarbons in formation water, etc. not included in other categories.
total hydrocarbons	5	5	4	5	
alkanes	5	5	4	5	
PAH	5	5	4	1	
polar compounds	5	5	4	2	
biocides	5	5	5	2	
other	5	5	5	2	
Indicator compounds	5	5	2	1	

PRIORITIES FOR BIOLOGICAL DATA

Examples of the kinds of data used to guide environmental management of offshore developments. The importance of the data to various phases of management is suggested by priority numbers. Priority values were based on the importance of the data in planning for the phases indicated at the heads of the columns. Priorities are: 1 - Essential; 2 - Valuable (i.e., should be collected if possible); 3 - Useful (i.e., worth collecting); 4 - Needed only for scientific completeness; and 5 - Irrelevant, (i.e., data not collected routinely). (After MacLaren Plansearch, 1982).

	WEST COAST				COMMENTS
	Design and Operation	Contingency	Impact Assessment	Impact Monitoring	
BIOLOGICAL DATA					
Phytoplankton					
biomass (carbon or extracted chlorophyll)	5	5	4	3	Annual cycle and areal variation of listed parameters.
species composition	5	5	4	4	
productivity	5	3	2	3	
chlorophyll concentration (in vivo)	5	3	1	5	Preferably measured continuously with temperature and salinity.
nutrient concentration	5	3	3	5	
Bacteria					
numbers	5	5	4	5	Annual cycle and areal variation of listed parameters.
biomass	5	3	3	5	Fraction of oleoclastic bacteria.
species composition	5	2	3	1	
productivity	5	2	3	5	
"heterotrophic and oleoclastic potential"	5	3	3	2	
oxygen	5	3	3	3	
Zooplankton					
biomass	5	3	3	5	Includes meroplankton but not ichthyoplankton. Annual and areal variation of listed parameters. Difficult to determine.
species composition	5	5	3	4	
productivity	5	5	3	5	
physiological indicators	5	5	3	1	
Fish					
biomass adults	5	5	4	5	Annual and areal variation of listed parameters.
species composition adults	5	5	4	3	
behaviour	5	2	2	5	
life history data of key species					
eggs	5	1	1	5	
larvae/ ichthyplankton	5	1	1	5	
juveniles	5	1	1	5	Difficult to sample.
adults	5	3	3	3	Age class distribution.
productivity	5	5	4	5	Must be determined indirectly.
fecundity	5	5	4	2	
other	5	5	4	1	Histology, epidemiology, parasitology, physiology.
Seabirds					
numbers and species composition	5	1	1	3	Annual cycle and areal variation.
location and size of colonies	5	1	1	3	
physiological responses	5	5	5	1	
Marine Mammals					
numbers and species composition	5	1	1	3	Annual cycle and areal variation.
location of breeding areas, colonies, feeding areas	5	1	1	3	
Benthos					
numbers	5	3	4	3	This is an assemblage of organisms that is at least as complicated as plankton, but it has been included under one heading. Indicator species.
biomass	5	2	2	2	
species composition	1	2	2	1	
life history	5	3	2	5	
productivity	5	5	3	2	Difficult to determine.
habitat description	1	5	2	5	
commercial species	1	1	1	1	
other	5	5	3	2	Histology, parasitology, physiology, fecundity, etc.
Resources	5	1	1	3	
Biota	5	1	1	3	
Biosensitivity	5	1	1	2	

5. OIL INDUSTRY RESEARCH AND DEVELOPMENT

THE FOLLOWING SURVEY OF OIL INDUSTRY OFFSHORE ENVIRONMENTAL R AND D ACTIVITIES IN CANADA IS NOT COMPREHENSIVE. MOST OF THE MAJOR OPERATORS PROVIDED INFORMATION, BUT IN SOME CASES COMPLETE LISTINGS OF RELEVANT RESEARCH ACTIVITIES OR RESEARCH EXPENDITURES WERE NOT PROVIDED.

5.1 MOBIL OIL CANADA, LTD.

TABLE 5-1

MOBIL OIL GRAND BANKS R&D PROJECTS RELEVANT TO PERD 6.7 - 1985

PROJECT	CONTRACTOR	COST($K)
WAVES AND CURRENTS		
Wave Hindcast Verification	MacLaren Plansearch	35
Wave Climate Evaluation	Seaconsult	35
Ocean Current Modelling	to be selected	100
SEA ICE AND ICEBERGS		
Iceberg Detection	Canpolar Consultants	255
Ice Mass Velocity	Arctic	250
Iceberg Towing	Fenco	35
Iceberg Aerial Reconnaissance	F.G. Bercha	270
Iceberg Flux Evaluation	Seaconsult	30
Iceberg Profiling Study	Dobrocky Seatech	300
Medium-Scale Ice Test	Geotech	2000
Motion of Ice	in Wavesin-house	50
OIL SPILL		
Monthly Shoreline Surveys for Beached, Oiled Seabirds	Memorial U.	5
Oilspill Countermeasures Workshop	in-house	20
DATA MANAGEMENT		
Environnmental Data Management	Seaconsult	150
OTHER		
GBS Environmental Site Survey	Seaconsult	35

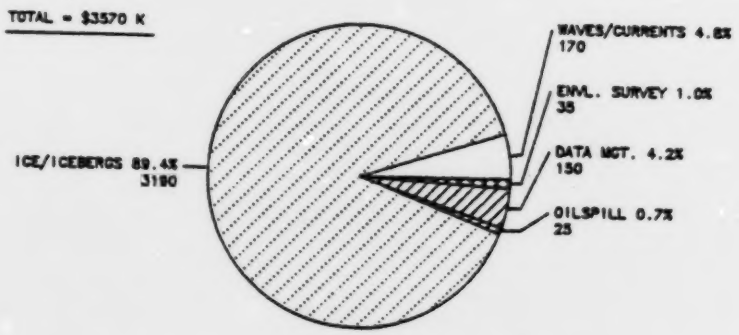


Figure 5-1. 1985 Mobil Oil Grand Banks Expenditures by Subject ($K) Subjects Relevant to PERD 6.7.

TABLE 5-2

MOBIL OIL GRAND BANKS RD
BY SUBJECT AREA RELEVANT TO PERD TASK 6.7 - 1985

SUBJECT AREA	$K
Waves and Currrents	170
Sea Ice and Icebergs	3190
Oilspill	25
Data Management	150
Environmental Site Survey	35
TOTAL	3570

MOBIL OIL SCOTIAN SHELF R&D
BY SUBJECT AREA RELEVANT TO PERD 6.7 - 1984/85

SUBJECT AREA	$K
Weather Waves and Currents	1000
Sea Ice and Icebergs	70
Monitoring Methods	50
Waste Treatment	20
TOTAL	1140

TABLE 5-3

MOBILE OIL ENVIRONMENTAL RESEARCH PRIORITIES (in order) ON THE SCOTIAN SHELF

	PHYSICAL ENVIRONMENT
1.	Iceberg Detection (very high)
2.	Ice/Iceberg in Waves
3.	Wave Climate Evaluation
4.	Ocean Current Regime
5.	Iceberg Drift Forecast
6.	Wave Forecasting

	IMPACTS
1.	Countermeasures for Waxy Crude Oils
2.	Effects of Oil on a Capelin Spawning Beach
3.	Effects of Waxy Crude Oil on Seabirds

TABLE 5-3

MOBILE OIL ENVIRONMENTAL RESEARCH PRIORITIES (in order) ON THE SCOTIAN SHELF

	PHYSICAL ENVIRONMENT
1.	Iceberg Detection (very high)
2.	Ice/Iceberg in Waves
3.	Wave Climate Evaluation
4.	Ocean Current Regime
5.	Iceberg Drift Forecast
6.	Wave Forecasting

	IMPACTS
1.	Countermeasures for Waxy Crude Oils
2.	Effects of Oil on a Capelin Spawning Beach
3.	Effects of Waxy Crude Oil on Seabirds

PETRO-CANADA OFFSHORE R AND D RELEVANT TO PERD 6.7
EXAMPLE PROJECTS - 1985

PHYSICAL ENVIRONMENT

Iceberg tracking/monitoring of speed

Iceberg forecasting

Remote sensing: testing of hardware and development of methods

Estimation of iceberg collision frequency

Development of parameter statistics for icebergs

Collection of site-specific field data on ocean climate, sea ice, icebergs

Data analysis methodologies for physical environment

IMPACTS

Injection Water and Formation Water Quality: chemical and biological characterization in the Terra Nova area (Terra Nova partners) (proposed for 1985)

Oil Spill Solidifier Countermeasures Evaluation (Petro-Canada, Terra Nova partners, Hibernia partners) (proposed for 1985)

Biofouling of Structures on the Grand Banks: 15-month field study (proposed for 1986)

Fish Tainting Monitoring: preproduction monitoring (proposed for 1986)

5.3 HUSKY OIL

Objectives

(1) Short-term R&D to meet specific offshore exploration operational requirements.

(2) Longer-term R and D for production planning.

Husky Oil and the Husky/Bow Valley East Coast project group are conducting research activities on the Scotian Shelf and the Grand Banks.

Projects

(1) Marine-Based Radar System for Identifying and Locating Small Icebergs at Great Distances. (A large-scale effort jointly funded by several East Coast operators.)

(2) Use of SLAR for Ice Surveillance ($700 000 in 1984).

(3) Rig-Based Temperature Profiles to Determine Internal Wave Motion on the Scotian Shelf (and effects on marine riser)[1].

(4) Surface Manifestations of Waves on the Grand Banks Shelf Edge[1].

(5) Bottom Sediment Transport Model Verification[1].

(6) Development of equipment for directing "bergie bits" and "growlers" away from drilling locations ($10,000. in 1984).

1 Initiated by Bedford Institute of Oceanography; continued by BIO with funding from industry.

5.4 ESSO RESOURCES CANADA LIMITED

Objectives

(1) Development of design criteria for exploration and future production in the Beaufort Sea and on the East Coast.

(2) Operational forecasting in support of offshore exploration.

(3) Regulatory compliance.

The focus of Esso Resources Canada Limited offshore research activities is on the Beaufort Sea, and to a lesser extent on the East Coast. The company has a Production Research Laboratory in Calgary.

Priorities - Beaufort Sea

PHYSICAL ENVIRONMENT

Current environmental data collection appears to be sufficient to meet industry needs. One area requiring further study to resolve an issue is:

1 Effects of artificial islands on ice

Priorities - East Coast

PHYSICAL ENVIRONMENT

1 On-going regional data collection and forecasting

2 Iceberg movement predicition

3 Methods for altering iceberg course

ESSO RESOURCES OFFSHORE R AND D PROJECTS RELEVANT TO PERD 6.7 -1985

Beaufort Sea Projects

WEATHER

Operation of two weather stations in the Mackenzie Delta (Garry Island) and on the Tuktoyaktuk Peninsula (Atkinson Point)

On-site monitoring of weather at all artificial island drilling platforms

WAVES AND CURRENTS

On-site monitoring at all drilling locations

Beaufort oceanographic measurements (regional) for currents, storm surge, wave heights and periods, and tides

Beaufort seastate studies

Determination of the effect of fetch (to develop wave height prediction capability using meteorological data)

SEA ICE

Monitoring of Beaufort sea ice conditions (to monitor effects of artificial islands on breakup; and for operational support)

Multi-year ice occurrence and effects

East Coast Projects

Site-specific data collection on Esso leases:

- weather
- waves and currents
- icebergs.

Oilspill Projects

Detection of Oil Under Ice (joint Esso/AMOP; $50K /y each; 1982-1985)

Dynamics of Oil in Open Leads

Followup data analysis on 1983 Offshore Dispersion Trials (joint-company funding)

Effectiveness of Dispersants in Cold Water

Simple Remote Sensing of Oil Spills

Application of Computer-Assisted Learning for oil spill response in various regions

Beach Protection (chemicals for reducing seepage)

5.5 DOME PETROLEUM LIMITED

Objectives

(1) Regulatory compliance.

(2) Development of design criteria.

(3) Operational monitoring.

Priorities (not in order)

OCEANOGRAPHY

1 Measurement of long-period waves

2 Additional data collection on ice scour (8-50m contour)

3 Development of winter and summer ice drift models

4 Multi-year ice thickness distribution

5 Effect of partial ice cover on wave fetch prediction (hindcast study)

6 Extreme ice feature frequency

OILSPILL

1 Response capability in broken ice

2 Dispersant application in the Beaufort Sea

Offshore R&D Activities conducted by Dome Petroleum Limited and relevant to PERD 6.7 for 1985 and given by subject area in Tables 5-4, 5-5 and Figure 5-2.

TABLE 5-4

DOME PETROLEUM OFFSHORE R AND D ACTIVITIES RELEVANT TO PERD 6.7 -1985

SUBJECT AREA		$K
WEATHER/OCEANOGRAPHY		
Operational Monitoring: (4 drill sites)	weather currents waves CTD profiles	650/y
SEA ICE		
Operational monitoring: (joint with Gulf)	airborne radar visual predictive models	2500/y
Controlled Multi-Year Ice Impacts Against an Offshore Structure (1984)		650
Investigation of Ice Forces at a Rubble Field at an Abandoned Well Site (berm) (1985 proposal for joint company funding)		430
Beaufort Sea Ice Movements from ARGOS Position Fixes (1985) (joint APOA/AOGA funded)		60
ECOLOGICAL MONITORING		
White Whale Hunter Liaison Program		35
Polar Bear Detection/Deterent Research (1983-1985) (joint industry, GNWT, federal departments)		
WASTE TREATMENT		
McKinley Bay Sewage Effluent Monitoring (1984)		5
Incineration of Oil-Based Drilling Mud (proposed 1985 NOGAP)		49
OILSPILL		
Reciprocating Kiln Field Test (COOSRA project)(1984)		11
Oil Recovery in Ice (COOSRA project)		81
Subsea Containment Feasibility Study (COOSRA project)		78
Shoreline Cleanup Study (development of air-portable mechanical cleanup device)		89
Novel Emulsion Separation Techniques (COOSRA project)		68
Evaluation of Environment Canada study of ability of tankers to respond to spills		7
Fluorosensor Study (feasibility of developing a portable sensor for oilspill detection from aircraft)		64

TABLE 5-5

DOME PETROLEUM R AND D EXPENDITURES BY SUBJECT AREA RELEVANT TO PERD 6.7 ($K)[1]

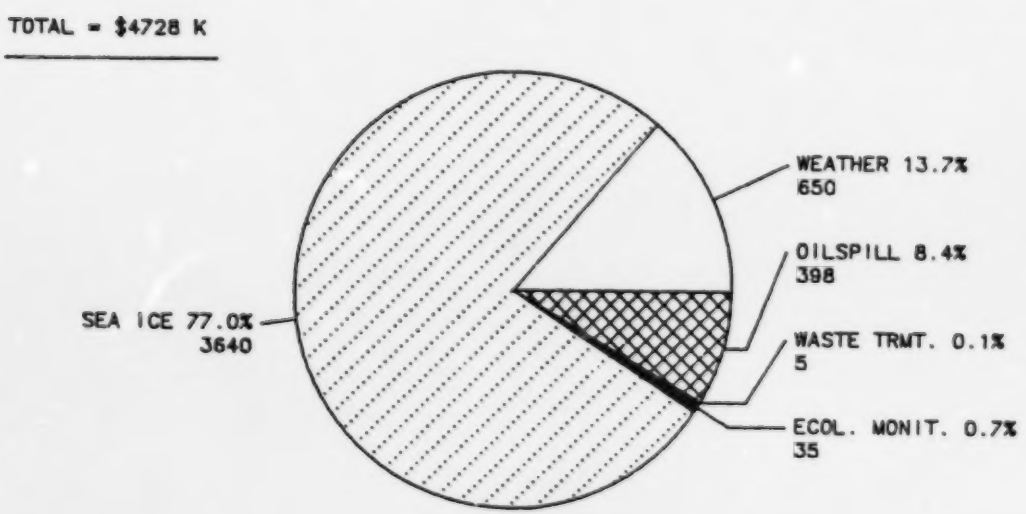
SUBJECT AREA	$K
Weather[2]	650
Sea Ice[2]	3640
Ecological Monitoring	35
Waste Treatment	5
Oilspill	398[3]
TOTAL	**4728**

1 A number of projects included in these totals, representing a considerable portion of expenditures, are joint-company funded; total costs are shown

2 Includes physical environment monitoring for operations

3 1984 and 1985; mostly joint company funded

Figure 5-2. 1985 Dome Petroleum Expenditures by Subject Area ($K) Subjects Relevant to PERD 6.7.



*Includes joint-company projects and and some 1984 projects

5.6 GULF CANADA RESOURCES INC.

Objectives

(1) Improvement of design and operating criteria for offshore expioration and development.

(2) Operational support.

(3) Regulatory compliance (monitoring to meet permit conditions and to develop documentation for project environmental assessment/review).

(4) Develop site-specific countermeasures for oil spills (no current work at Gulf, except through contribution to work by others).

Program Areas

(1) Physical Environment Definition: (regional and generic)
- ice
- meteorology
- oceanography
- geotechnics

(2) Ocean Engineering:
- ice (site-specific)
- performance monitoring
- coastal
- geotechnics

(3) Operational Support:
- forecasting

Priorities (not in ranked order)

1 Pack ice driving forces

2 Wave and current forces on pipelines

3 Extreme ice features in Beaufort

4 Ice movement forecasting: Beaufort Sea and transportation corridors

GULF CANADA RESOURCES R AND D ACTIVITIES RELEVANT TO PERD 6.7: EXAMPLE PROJECTS

WEATHER

Data acquisition at offshore well sites

Statistical formatting of wind information

Operational monitoring and forecasting for real-time decision-making (all relevant physical environment parameters)

SEA ICE

Digitized data bank for sea ice information

Regional study of local ice pressures

Improved definition of a pressure-area curve for global and local ice loads

Discrete-Element Ice Structure Interaction Model (joint company funded)

Probabilistic Ice-Load Model for Offshore Structures (joint company funded)

ECOLOGY

Infrared surveys of seal habitat (past study)

5.7 Panarctic Oils Ltd.

Objectives

(1) Serve operational requirements.

(2) Regulatory compliance.

Panarctic's activities are completely focussed on the high Arctic.

Priorities for the High Arctic

1 Data and interpretation on extreme ice features and effect on ice scour.

PANARCTIC PAST R AND D PROJECTS RELEVANT TO PERD 6.7

WEATHER

Meteorological data collection and operation of a computer data base. (AES provides forecasts using data collected by Panarctic)

CURRENTS

Current data have been collected at between 15 and 20 locations in the high Arctic. (Data are interpretted by DFO/IOS to provide assessment of overall current patterns; IOS Data Assessment program has provided good handle on these data sets)

SEA ICE

Satellite tracking of ice motion using JMR receivers (1976-1981). (Level of effort was $3000K to $4000K per year, with total expenditure of $20 000K to $25 000K)

Ice scour from extreme features (1976-1977).

Ice thickness measurements and interpretation (5000 to 10 000 data points per year)

ECOLOGICAL MONITORING

Considerable survey work has been done as part of regulatory requirements.

(list to be provided)

OILSPILL

Blasting of oil containment trenches in multi-year ice (1980) (approximately $100K)

Methods for containment of fuel spills on ice (1984) (approximately $100K)

5.8 Arctic Petroleum Operators Association (APOA)

A considerable number of offshore environmental studies have been carried out by the organization. Thoses studies currently being conducted which are relevant to PERD 6.7 are shown in Table 5-6.

TABLE 5-6

APOA PROJECTS RELEVANT TO PERD 6.7 - 1984 AND 1985

SUBJECT AREA	$K
OCEANOGRAPHY/MARINE ENGINEERING	
Environmental Design Criteria for Arctic Offshore Platforms	705
SEA ICE	
Upward-Looking Ice Profiler	83
Tarsiut Island Ice Stress Sensor and Telemetry Program (1984)	450
Design Criteria and Ice Interaction Study	184
Controlled Ice Flow Impacts Against Structure	
Statistical Analysis of Ice Movement in Beaufort Sea Using Argos Buoy Data	82
OILSPILL	
Dispersant Areas of Application in the Beaufort Sea	50
TOTAL	**2157**

5.9 Summary of Industry R and D in the Beaufort Sea Region

TABLE 5-7

OIL INDUSTRY R AND D EXPENDITURES IN THE BEAUFORT SEA BY SUBJECT AREA: 1985[1]

SUBJECT AREA	RESOURCES $K (p-y)			
	Company A	Company B	Company C	TOTAL
Regional/generic physical environment	1500 (20[2])	1000 (5)	60 (2.5[2])	2560 (27.5)
Ocean engineering (relevant to PERD 6.7)	300	N/A	430	730
Operational monitoring and forecasting	2500	-	3150	5650
Ecological Monitoring	N/A	100 (1)	50 (0.1)	150 (2.1)
Oilspill studies	-	400 (1+)	400[3] (1.5) 800	(1.5+)
Waste treatment monitoring			5	5

1 This tabulation is not comprehensive; it represents approximations of level of effort only; a number of the projects which comprise these company summaries are joint-funded with other companies.

2 Includes operational monitoring and ocean engineering

3 1984 and 1985; mostly joint-funded

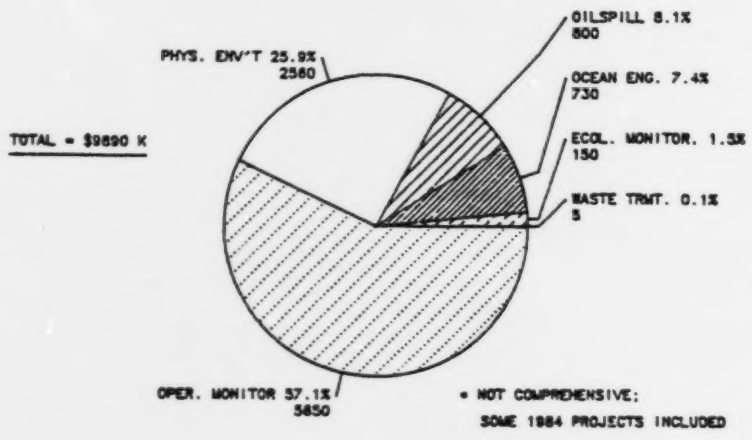


Figure 5-3. 1985 Oil Industry Expenditures in Beaufort Sea ($K) Subjects Relevant to PERD 6.7.

6. OTHER OFFSHORE ENVIRONMENTAL RESEARCH AND DEVELOPMENT

6.1 Centre for Cold Ocean Resources Engineering (C-CORE)

C-CORE is a non-profit research organization established in the 1970s to conduct engineering R and D in support of offshore resource development. It is funded through grants from a number of petroleum companies involved in offshore exploration and development, and from revenues gained from contract research for government departments and industry.

Objectives

(1) Address urgent problems related to offshore resource exploitation.

(2) Develop technology to foster safer and more economical offshore operations.

Structure

The Director of C-CORE reports to the President of Memorial University of Newfoundland, for administrative purposes. For all technical matters, including the setting of research priorities, the Director works with the C-CORE Board of Governors and a Research Program Advisory Committee. Annual workshops are held with Associate Members (funders) to help provide research direction.

Research Programs

C-CORE's activities are divided into three research programs and a small number of support programs.

TABLE 6-1

C-CORE RESEARACH PROGRAM AREAS 1984/1985

SUBJECT AREA	INCURRED COST ($K)*	P-Y	% RECOVERED FROM CONTRACTS
Remote Sensing Research	240	6	37
Ice Properties Research	1140	10	39
Seabed Research	400	6	25
Ocean Engineering Information	120	3	60
TOTAL	**1900**	**25**	

* For real costs, including overhead, multiply by two.

C-Core research projects for 1984-85 are listed in Table 6-2.

TABLE 6-2

C-CORE RESEARCH PROJECTS 1984/1985

ICE PROPERTIES

Iceberg Temperatures
Wave-Ice Interaction
Canadian Marine Ice Guide (PERD Project)
Iceberg Fragmentation
Ice Tank Experiment
Adams Island Current Project (PERD Project)
Development of Iceberg Penetrator
Wave Induced Ice Motions (NSERC Funding)

REMOTE SENSING

Analysis of CODAR Data (PERD Project)
HF System Development
Cape Sable CODAR Experiment (PERD Project)
Analysis of Iceberg Detection - HF Radar (NSERC Funding)

SEABED

Drifters 1979
Marine Geology Upper Continental Slopes off Eastern Canada
Iceberg Grounding and Scouring Prediction Study
Hopedale Saddle
Hibernia Sediments Program (PERD Project)
Gjoa Haven Relict Scours
Probability of Grounding and Scouring
Labrador Shelf Iceberg Scouring
Hibernia Submersible Program (PERD Project)
Geotechnical Review
Analysis of Iceberg Velocities
Up/Down Slope Scouring (ESRF Project)
Repetitive Scour Mapping
Properties of Near Surface Soils

OCEAN ENGINEERING INFORMATION CENTRE

Centre Operation
K.W.O.C. Index
O.E.I.C. Information Bulletin
Northern Library Colloquy
Indexing Cold Ocean Literature

7. LITERATURE CITED

7. LITERATURE CITED

Arctic Laboratories, 1984. Research and monitoring priorities for Fisheries and Oceans Canada (Western Region) in the Canadian Arctic identified at the habitat surveys workshop, Winnipeg, November 1984. Prepared by D.J. Thomas and W.S. Duval. December 22, 1984.

British Columbia Ministry of Environment. 1983. A preliminary environmental assessment of offshore hydrocarbon exploration and development. R.W. Langford (ed.). 334 pp.

Duval, W.S. and A. Birdsall, 1985. 1984-85 Beaufort Environmental Monitoring Project (BEMP): a review of past activities and current research and monitoring programs. Prepared for Indian and Northern Affairs Canada, Ottawa, Canada. January, 1985.

LGL Environmental Research Associates, ESL Environmental Sciences Limited and ESSA Environmental and Social Systems Analysts Ltd. 1984. Beaufort environmental monitoring project 1983-1984 final report. Prepared for Northern Environment Protection Branch, Indian and Northern Affairs Canada. March, 1984.

Environmental Studies Revolving Funds (ESRF), 1983. ESRF Update 1(1)., September 16, 1983.

Northern Oil and Gas Action Plan (NOGAP), 1984. Internal document prepared for the NOGAP Committee of Coordinators and the Senior Planning Committee, Northern Resource Development Projects.

Office of Energy R and D (OERD), 1984. Federal Energy R and D: Task 6 conventional energy systems oil, gas, electricity accomplishments 1981-1983. Internal report compiled by Bryan Cook and Yvonne Van Ruskenveld.

APPENDIX B

PERD 6.7 Program Accomplishments, 1981 - 1983

Projects selected and presented in this appendix have yielded accomplishments which have been implemented by industry or by government agencies responsible for regulation or the provision of services. Only in areas of fundamental research have basic advances in knowledge been identified as "accomplishments". It is worth noting that energy R&D has frequently provided seed money for a project which has later been carried through to commercial application using other industrial support funds of the Federal Government.

The "Ice Atlas for Canadian Arctic Waterways" was compiled by W.E. Markham of the Atmospheric Environment Service, Environment Canada. It consolidates historical AES ice chart data for the Arctic Ocean for the period 1959-1974 into weekly ice charts. It details, in a large four-colour format, the median amounts of all ice and old ice; maximum and minimum reported conditions; timing and amounts of new ice appearance; winter conditions; ice regions; break-up and freeze-up patterns; general patterns of ice movement; icebergs and ice islands; and a range of meteorological parameters. It is a major reference used widely by industry, consultants and government departments as a first-order consolidation of basic information required to estimate windows and conditions for marine operations in the Arctic. It has recently been revised by AES to include data collected up to 1980.

In February 1984, drilling operations of the JOHN SHAW on the Grand Banks were interrupted and the rig moved to avoid ice. A similar incident last year led to the question of whether such occurrences are to be expected every year. The Atlantic Oceanographic Laboratory (DFO/BIO) examined ice climatology information for the area which has been gathered as part of the Sea Ice Program. Available sea ice data sets were combined into an edited archive for analysis and initial results indicate that pack ice could be expected in this region approximately once every 8 years. However, there appears to be some persistence from one year to the next, i.e. one heavy ice year tends to be followed by another. Therefore, 1984 would be expected to be fairly heavy because 1983 was. On average the maximum extent of the ice occurs in early March. During the coming year, similar information for the Labrador and Newfoundland region will be published and available to rig operators.

The ice forecasting projects of AES have resulted in the following achievements and spin-off benefits to the private sector:

- A free-drift ice forecast model was implemented at Ice Forecast Central to depict vector displacement of sea ice features in the forecast period as guidance in the preparation of ice charts distributed to users throughout Canada.

- The major consultant in the Beaufort Sea Winter Ice Experiment (Intera Environmental Consultants, Calgary) applied for a non-exclusive licence to operate the fine scale ice forecast model. Under contract to Dome Petroleum, they have since been using the model in support of the offshore activities of operations in the Beaufort Sea. Research is now focussed on improving what has to date been poor operational performance.

- As a sub-contractor to Intera for the Beaufort Sea Winter Ice Experiment, Prof. J. Sykes of the University of Waterloo provided a significant contribution to numerical methods in ice forecast models. As a result, he has led the development of a strong research activity in ice modelling which includes post-graduate research.

- The principal consultant in the development of the ice dynamics model and the mounting of the prototype ice forecast system at Ice Forecast Central (Meteorological and Environmental Planning Ltd.) utilized the expertise gained in model development and operational system design to develop and successfully market an oil spill trajectory forecast system which is recognized nationally and internationally, as state-of-the-art in trajectory modelling. For applications where sea ice is present, it will be necessary to mesh their oil spill system with the ice dynamics model they have developed.

- The Resource Analysis and Mapping System adapted for ice fields has been integrated into the operational routines at Ice Forecast Central. Features of the system developed for ice purposes have been successfully adapted for other applications and marketed by the principal contractor (Systemhouse Inc.).

- Models for predicting the mean daily drift of iceberg ensembles and iceberg deterioration rates have been developed for incorporation in the AES Ice Services Program.

Icebergs pose a major threat to marine developments, particularly offshore from Newfoundland. A good prediction of the short-term movement of a threatening iceberg is valuable when selecting counter-measures, and when towing. A model developed at Dalhousie University predicts, within an error range, the future course of an iceberg based on statistical analysis of its past movement. Results are better than those from a deterministic model, and error formulation has now been incorporated in a commercially available predictor (NORDCO). The accuracy of the model is now being improved, particularly by incorporating better data from other studies and new instrumentation measuring local winds and currents.

A major accomplishment in environmental forecasting has concerned the development of a parametric wind-wave forecast model which has been installed in the Canadian Meteorological Centre in Montreal. In trials this model showed a capability equal or superior to the present human judgement forecasting method, and fine tuning of the model is now underway prior to adoption as a primary forecasting methodology. The principal contractor (Meteorological and Environmental Planning Limited) has adapted and successfully marketed a Beaufort Sea version of the system.

To support marine weather forecasting, a data system has been developed for generating emperical marine weather forecasts. Forecast equations of surface winds have been developed for east coast and Beaufort Sea marine areas. These will be evaluated for their ability to provide higher quality data to ice and sea state forecast systems. The principal contractor (ACRES Consulting Services Ltd.) is marketing their capability in data base systems.

Real-time measurements of currents in the upper 100 m of the ocean are required over large areas for prediction of iceberg movements. Two acoustic doppler systems have been evaluated as real-time current measuring devices: one boom-mounted portable system and one permanently installed on the CSS DAWSON research vessel at BIO. Use of the "over-the-side" system is limited by rough seas and ice-infested waters, but it is readily available to researchers since it is not dependent on the availability of the DAWSON. The first application of the portable system was in offshore oil-spill tests conducted by the Canadian Offshore Oil Spill Research Association (COOSRA - an industry group) in September 1983 to monitor surface currents in the spill vicinity. Several cruises have been taken to test the systems, which showed that acoustic profiling is an efficient and cost effective method for large scale ocean current surveys.

The Bayfield Laboratory (DFO) developed an unmanned profiling system to measure current speed, temperature and conductivity under ice cover. The unit was field tested in conjunction with the Laboratory's research of the freshwater plume extending under the ice in Hudson and James Bays and the possible effects of hydroelectric power developments. The unit was then complemented with a gyro-orientation capability to obtain a time-series of vertical profiles under shorefast Arctic ice. The profiler has been extensively utilized in the Barrow Strait region to study oceanic heat flow to the under side of the ice surface and its relation to water mass movement, in support of transportation of oil and gas through the Northwest Passage.

PERD 6.7 Program Accomplishments, 1981 - 1983

Projects selected and presented in this appendix have yielded accomplishments which have been implemented by industry or by government agencies responsible for regulation or the provision of services. Only in areas of fundamental research have basic advances in knowledge been identified as "accomplishments". It is worth noting that energy R&D has frequently provided seed money for a project which has later been carried through to commercial application using other industrial support funds of the Federal Government.

The "Ice Atlas for Canadian Arctic Waterways" was compiled by W.E. Markham of the Atmospheric Environment Service, Environment Canada. It consolidates historical AES ice chart data for the Arctic Ocean for the period 1959-1974 into weekly ice charts. It details, in a large four-colour format, the median amounts of all ice and old ice; maximum and minimum reported conditions; timing and amounts of new ice appearance; winter conditions; ice regions; break-up and freeze-up patterns; general patterns of ice movement; icebergs and ice islands; and a range of meteorological parameters. It is a major reference used widely by industry, consultants and government departments as a first-order consolidation of basic information required to estimate windows and conditions for marine operations in the Arctic. It has recently been revised by AES to include data collected up to 1980.

In February 1984, drilling operations of the JOHN SHAW on the Grand Banks were interrupted and the rig moved to avoid ice. A similar incident last year led to the question of whether such occurrences are to be expected every year. The Atlantic Oceanographic Laboratory (DFO/BIO) examined ice climatology information for the area which has been gathered as part of the Sea Ice Program. Available sea ice data sets were combined into an edited archive for analysis and initial results indicate that pack ice could be expected in this region approximately once every 8 years. However, there appears to be some persistence from one year to the next, i.e. one heavy ice year tends to be followed by another. Therefore, 1984 would be expected to be fairly heavy because 1983 was. On average the maximum extent of the ice occurs in early March. During the coming year, similar information for the Labrador and Newfoundland region will be published and available to rig operators.

A study entitled "Offshore Oil and Gas Production Waste Characteristics, Treatment Methods, Biological Effects and their Applications to Canadian Regions" was completed in November 1983 for the Environmental Protection Service. The results were presented and discussed in a series of seminars in March 1984 in St. John's, Halifax, Ottawa and Calgary and in June 1984 in Yellowknife: participants included both government and industry representatives. The report provided input to the Environmental Assessment Review Process for offshore developments and identified regulatory and research requirements.

A survey of five abandoned well sites in the Hibernia region by EPS, showed that under current exploratory drilling practices and regulations no debris is left of sufficient size to be of concern to the commercial fishery. Traces of chemicals from drilling operations were detected in biota and sediments in the immediate vicinity of the well sites. Their significance is the subject of an ESRF evaluation, which may lead to further research.

A review contracted for by the Environmental Protection Service (EPS/DOE) has concluded that current abandonment practices for artificial islands in the Canadian Beaufort Sea have had no significant effect on the physical, chemical or biological environment. No effects have been observed on timing of break-up or extent of landfast ice, distribution of marine mammals, and hunting and trapping practices. The potential hazards to navigation could be alleviated by accurate charting, permanent navigation aids, or scalping in designated navigation corridors, (as contemplated in recent policy guidelines under the Navigable Waters Protection Act).

APPENDIX C

DEFINITIONS

Pure (Basic) Research - systematic investigation undertaken for the advancement of scientific knowledge with no specific application in view.

Applied Research - systematic investigation undertaken for the advancement of scientific knowledge with a specific practical application in view.

Development - use of the results of basic or applied research for the purpose of creating new or improving existing materials, devices, products or processes.

Energy R&D - research and development projects with the objective of developing technologies, models or methods:

- which either save, supply or more efficiently use energy
- which enable the Federal government to develop and use codes, standards and regulations to ensure that safety, consumer protection and health concerns relating to energy developments are answered
- which measure, monitor or ameliorate the impacts of energy developments on the environment
- which lead to improved energy-related engineering design criteria
- which improve the forecasting of environmental states in areas of energy development

Data Collection/Analysis	- the experimental measurements taken in support of pure or applied research and development (includes baseline measurements).
Effects Monitoring	- test of an impact hypothesis designed to measure environmental impact and analyse cause-effect relationships.
Operational Monitoring	- data collection for use explicitly in offshore operations.

APPENDIX D

APPENDIX D

LIST OF PARTICIPANTS AT THE WORKSHOP ON OFFSHORE ENVIRONMENTAL RESEARCH AND DEVELOPMENT RELATED TO OIL AND GAS ACTIVITIES IN CANADA

Name	Affiliation	Mailing Address	Telephone
Hubert Allard	AES/DOE	4905 Dufferin St. Downsview, Ontario M3H 5T4	(416) 667-4808
Betty Ann Balfour	OEA/EMR	580 Booth St. Ottawa, Ontario K1A 0E4	(613) 995-2833
Peter Blackall	EPS/DOE	804, 9942 - 108 St. Edmonton, Alberta T5K 2J5	(403) 420-2572
Bob Boulden	EPS/DOE	Plaza Vincent Massey Ottawa, Ontario K1A 0H5	(810) 997-4334
Bill Bruce	DOE	801 - 9942 108 St. Edmonton, Alberta T5K 2J5	(403) 420-2554
Diane Campbell	OERD/EMR	580 Booth St. Ottawa, Ontario K1A 0E4	(613) 995-9351
Don H. Champ	AES/DOE	4905 Dufferin St. Downsview, Ontario M3H 5T4	(416) 667-4727
F. Joe Eley	Gulf Canada Resources Inc.	Box 130 Calgary, Alberta T2P 2H7	(403) 233-4352
Jim A. Elliott	DFO/BIO	Bedford Institute of Oceanography Dartmouth, N.S.	(902) 426-2502
Anders Elverhoi	NPRI (Norway)	4712 - 13 St. N.E. Calgary, Alberta T2E 6P1	(403) 250-9790
Rainer Engelhardt	COGLA	355 River Road Ottawa, Ontario K1A 0E4	(613) 993-3760
John Garrett	DFO/IOS	Sidney, B.C. V8L 4B2	(604) 656-8274

Name	Affiliation	Mailing Address	Telephone
Ron Goodman	Esso Resources Canada Ltd.	339 - 50 Ave. S.E. Calgary, Alberta T2B 3A3	(403) 259-0296
George Greene	Consultant	66 Lees Avenue Ottawa, Ont. K1S 0B9	(613) 237-6673
Hugh A. Hall	EPS/DOE	45 Alderney Dr. Dartmouth, N.S.	(902) 426-8301
Joy Harmon	C-Core	Memorial University St. John's, Nfld. A1B 3X5	(902) 737-8354
Chris Hill	Canmar	P.O. Box 200 Calgary, Alberta T2P 2H8	(403) 231-1959
Geoff Holland	DFO/OSS	200 Kent St. Ottawa, Ontario K1A 0E6	(613) 990-0303
John Hollins	EC/EPG	Ottawa, Ontario K1A 1C7	(819) 994-5167
Scott Howarth	EPS/DOE	P.O. Box 370 Yellowknife, N.W.T. X1A 2N3	(403) 873-3456
Howard Hume	Petro Canada	P.O. Box 2844 Calgary, Alberta T2P 8E3	(403) 232-8000
George A. Issac	AES/DOE	4905 Dufferin St. Downsview, Ont. M3H 5T4	(416) 667-4683
Ron Johnson	R.D. Johnson & Assoc.	200, 409 - 8 Ave. S.W. Calgary, Alberta T2P 1E3	(403) 262-2860
Brad Johnston	BP Resources	333 - 5 Avenue S.W. Calgary, Alberta T2P 3B6	(403) 237-1369
Gordon H. Jones	APOA	1902 - 727 - 6 Ave. S.W. Calgary, Alberta T2P 0V1	(403) 265-1161
Kelly R. Karr	EC, Oil Gas Div./DOE	Place Vincent Massey 351 Boulevard St. Joseph Hull, Quebec K1A 1C8	(819) 997-1220

Name	Affiliation	Mailing Address	Telephone
Joe Kiceniuk	FRB	Box 5667 St. John's, Nfld. A1C 5X1	(709) 772-2087
Gordon Koshinsky	DFO/FWI	501 University Cr. Winnipeg, Manitoba R3T 2N6	(204) 949-5062
Ed Kustan	Canadian Superior	3 Calgary Place 355 - 4 Ave. S.W. Calgary, Alberta	(403) 267-4184
Bob Lane	EPS/DOE	9942 - 108 Street Edmonton, Alberta T5K 2J5	(403) 420-2570
Mark Lesky	Husky Oil	P.O. Box 6525 Stn. D 707 - 8 Avenue S.W. Calgary, Alberta T2P 3G7	(403) 298-6767
Ed Lewis	DFO/OSS	Bayfield Laboratory Ocean Science and Surveys 867 Lakeshore Road Burlington, Ontario L7R 4A6	(416) 637-4356
Olav Løken	ESRF/INAC	DIAND Ottawa, Ontario K1A 0H4	(819) 997-3142
Ken Mann	DFO/BIO	Bedford Institute of Oceanography Box 1006 Dartmouth, N.S. B2T 4A2	(902) 426-3696
Jim McComiskey	Gulf Canada Resources Inc.	P.O. Box 130 Calgary, Alberta T2P 2H7	(403) 233-5253
Doug McKone	DFO/FM	200 Kent St. Ottawa, Ontario K1A 0E6	(613) 990-0285
Ken Meikle	DOE/EPS	River Rd. Env. Tech. Centre Ottawa, Ontario K1A 1C8	(613) 998-9622
Simon Melrose	Petro Canada	P.O. Box 2844 Calgary, Alerta T2P 3E3	(403) 296-5337

Name	Affiliation	Mailing Address	Telephone
John Mitchell	Transport Canada/ ROE	Place de Ville Ottawa, Ontario	(613) 995-0141
Langley Muir	COGLA	355 River Road Ottawa, Ont. K1A 0E4	(613) 993-3760
Jeannette Nixon	Gulf Canada Resources Inc.	P.O. Box 130 Calgary, Alberta T2P 2H7	(403) 233-3829
Chris Noll	Newfoundland Petroleum Directorate	Box 4750 St. John's, Nfld. A1C 5T7	(709) 737-2370
Bob O'Neil	Canada Centre for Remote Sensing/EMR	2464 Sheffield Rd. Ottawa, Ontario K1A 0Y7	(613) 998-9060
Glen Packman	EPS/DOE	P.O. Box 370 Yellowknife, N.W.T. X1A 2N3	(403) 873-3456
Bob B. Pan	Gulf Canada Resources Inc.	P.O. Box 130 Calgary, Alberta T2P 2H7	(403) 233-4150
Gaston Poulin	AES/DOE	Ottawa, Ontario K1A 1C7	(819) 997-6656
David Peakall	CWS/DOE	Ottawa, Ontario K1A 0E7	(819) 997-2760
Ed Pessah	Dome Petroleum Limited	P.O. Box 200 Calgary, Alberta T2P 2H8	(403) 231-8078
Martin Pomeroy	EPS/DOE	Kapilano 100 Park Royal West Vancouver, B.C.	(604) 666-6711
Wayne Richardson	EC/CPG/DOE	Ottawa, Ontario	(819) 994-5166
Andrej Saulesleja	AES/DOE	4905 Dufferin St. Downsview, Ont. M3H 5T4	(416) 667-4618
David Scarratt	DFO	St. Andrews, N.B.	(506) 529-8854

Name	Affiliation	Mailing Address	Telephone
T. Spearing	Chevron	500 - 5 Avenue S.W. Calgary, Alberta T2P 0L7	(403) 234-5184
Wayne Speller	Petro Canada	P.O. Box 2844 Calgary, Alberta T2P 3E3	(403) 296-5331
Jim W. Steen	Dome Petroleum Limited	Box 200 Calgary, Alberta T2P 2H8	(403) 231-8009
Dick Stoddart	DFO/OSS	200 Kent St. Ottawa, Ontario K1A 0E6	(613) 990-0302
David Stone	DIAND	Northern Env. Terrasses de la Chaudiere Ottawa, Ontario K1A 0H4	(819) 997-0044
Jim Swiss	Dome Petroleum Limited	P.O. Box 200 Calgary, Alberta T2P 2H8	(403) 231-3000
Dave Thomas	Seakem Oceanography Ltd.	2045 Mills Rd. Sidney, B.C. V8L 3S1	(604) 656-0881
Bill Thompson	Petro Canada	P.O. Box 2844 Calgary, Alberta T2P 3E3	(403) 296-5335
Del Trobak	Dome Petroleum Limited Environment Operations	P.O. Box 200 Calgary, Alberta T2P 2H8	(403) 231-8022
Nick Tywoniuk	DOE	804 - 9942 108 St. Edmonton, Alberta	(403) 420-2552
Martin Van Ieperen	Panarctic Oils	815 - 8 Ave. S.W. Calgary, Alberta	(403) 269-0534
S. Venkatesh	AES/DOE	4905 Dufferin St. Downsview, Ont. M3H 5T4	(416) 667-4849

Name	Affiliation	Mailing Address	Telephone
John Ward	Dome Petroleum Limited	P.O. Box 200 Calgary, Alberta T2P 2H8	(403) 231-8077
Howard Westergard	Canterra	P.O. Box 1051 Calgary, Alberta	(403) 294-3611
Brian Wilson	EPS/DOE	P.O. Box 370 Yellowknife, N.W.T. X1A 2N3	(403) 873-3456
Robert Wilson	DFO/IOS	P.O. Box 6000 Sidney, B.C.	(604) 656-8335
Barry Worbets	Canterra	P.O. Box 1051 Calgary, Alberta	(403) 267-9443
Colin Wykes	EPS/DOE	Room 225 Fed. Bldg. Whitehorse, Yukon	(403) 667-6487

APPENDIX E

APPENDIX E

LIST OF ATTENDEES AT THE PERD 6.7 COMMITTEE MEETING, FEBRUARY 13, 1985.

MEMBERSHIP LIST

Interdepartmental Panel on Energy R&D (PERD)
Conventional Energy Systems Task
Environment Committee

Wayne Richardson (Co-Chairman)
Environment Canada
Corporate Planning Group
22nd Floor
Les Terrasses de la Chaudiere
Ottawa, Ontario
K1A 0H4 (819) 994-1516

Dick Stoddart (Co-Chairman)
Department of Fisheries and Oceans
200 Kent Street, 12th Floor
Ottawa, Ontario
K1A 0E6 (613) 990-0302

Langley Muir
COGLA
355 River Road, Tower B
Vanier, Ontario
K1A 0E4 (613) 993-3760

Rainer Engelhardt
COGLA
355 River Road, Tower B
Vanier, Ontario
K1A 0E4 (613) 993-3760

David Stone
INAC
10 Wellington Street, 6th Floor
Les Terrasses de la Chaudiere
Ottawa, Ontario
K1A 0H4 (819) 997-0044

Betty Ann Balfour
Office of Environmental Affairs
Energy, Mines and Resources
580 Booth Street
Ottawa, Ontario
K1A 0E4 (613) 995-2833

John Mitchell
Transport Canada
Place de Ville, Section "A",
Tower "C"
21st Floor
Ottawa, Ontario
K1A 0N5 (613) 995-0141

Wayne Speller
CPA/OOD (Petro Canada Ltd.)
PCCW - 15th Floor
150 - 6th Avenue S.W.
P.O. Box 2844
Calgary, Alberta
T2P 3E3 (403) 296-5331

Ed Pessah
APOA (Dome Petroleum Ltd.)
12th Floor
1st Canadian Centre
6th Avenue S.W.
Calgary, Alberta (403) 231-8078

Gaston Paulin
Atmospheric Environment Service
Environment Canada
27th Floor
Les Terrasses de la Chaudiere (819) 997-6656

Doug McKone
Fisheries Research Directorate
Atlantic Fisheries Service
Department of Fisheries & Oceans
200 Kent Street
Ottawa, Ontario
K1A 0E6 (613) 990-0285

Kelly Karr
Environment Canada
Environmental Protection Service
13th Floor
Place Vincent Massey (819) 997-1220

Diane Campbell for Bryan Cook
Office of Energy Research and Development
580 Booth Street
Ottawa, Ontario
K1A 0E4 (613) 905-9351

Other Attendees

George Greene
66 Lees Avenue
Ottawa, Ontario (613) 237-6673

Dave Thomas
Seakem Oceanography Ltd.
2045 Mills Road
Sidney, B.C.
V8L 3S1 (604) 656-0881